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TROPICAL DISEASES BULLETIN

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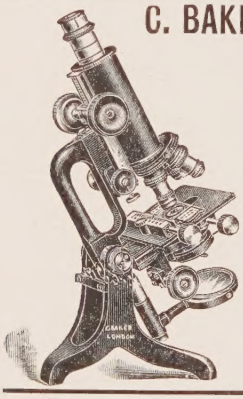

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TROPICAL DISEASES BUREAU.

TROPICAL DISEASES BULLETIN.

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KALA AZAR (AND TROPICAL SORE).

LAVORI DELLA SOCIETA ITALIANA DI PATOLOGIA ESOTICA. **Quarta Riunione tenuta a Messina il 27–28 Giugno 1914.** (Pubblicazione per Mandato del Consiglio Direttivo ad Opera del Prof. Dott. Umberto GABBI.)—194 pp. With 3 coloured plates and 1 text fig. 1914. Roma: Tipografia Moderna, Via Portico d'Ottavia 57.

GATTI (G.), pp. 41–53.

This paper, with the addition of a description of some further cases has appeared in *Pediatria*, Nov., 1914 [see below].

VAGLIO (R.), pp. 53–57.

CANNATA has already announced that he has been able to find leishmania in the peripheral blood of 15 out of 16 cases of infantile kala azar examined [this *Bulletin*, Vol. 3, p. 545]. The author has repeated the observation in eight cases with a positive result in every one. Some of these cases are mentioned by GATTI in his paper on infantile kala azar in and around Naples reviewed in this number.

LUNA (F.), pp. 57–60.

The experiments here recorded have to do with the growth of leishmania on N.N.N. medium under aerobic and anaerobic conditions (oxygen removed by pyrogallate of potash) or in an atmosphere of hydrogen. The tubes were inoculated either in the water of condensation or on the surface of the agar. The results obtained show that growth proceeds well under either aerobic or anaerobic conditions. In an atmosphere of hydrogen, however, the cultures quickly die.

RUTELLI (G.), pp. 60–61.

Seven cases of infantile kala azar were examined by the author and parasites were found in the peripheral blood of every one.

MAGGIORE (S)., pp. 62–63.

The record of a case of infantile kala azar in a child 10 months old, whose blood definitely agglutinated the *Micrococcus melitensis* in a dilution of 1 in 1,000. Culture from the blood was not attempted. The interest of the case is in the double nature of the infection.

RUTELLI (G.), pp. 64–65.

The author inoculated eight mice by way of the caudal vein with spleen juice from a case of infantile kala azar. The animals were killed after the lapse of twenty days. At autopsy there was no noticeable change in the organs, but parasites in small numbers were found in the livers of all, in the bone marrow of two, and never in the spleen.

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Pavoni (G.), pp. 65–68, and *Malaria e Malat d. Paesi Caldi*, 1914. Sept.-Dec. Vol. 5. Nos. 5–6, pp. 364–367.

The author has investigated the reaction of complement deviation in both kala azar and oriental sore. In two cases of oriental sore there was complete deviation of the complement, while in kala azar the result was nearly always negative. It was positive, however, in cases which recovered, while in chronic cases it was sometimes positive, though it might disappear if the case suddenly became worse. In cases of kala azar of normal course it was invariably negative. In the case of 45 children and 25 adults tested as controls there was always a negative result. The antigen used was an aquous extract of an infected spleen, and the number of cases of kala azar investigated was thirty-four.

Abate (A.), pp. 68–74.

An account of 21 cases of infantile kala azar observed in the children's clinic of Professor Longo in Catania since June, 1913.

A series of papers follows on the complications of kala azar under the headings :—" Introduction," by Professor U. Gabbi, pp. 75–77 ; " Complications of the Mouth and Ears," by Professor U. Gabbi, pp. 77–82 ; " Complications of the Respiratory Tract," by Dr. G. Spagnolio, pp. 83–86 ; " Complications of the Digestive Apparatus," by Dr. G. di Cristina, pp. 86–92 ; " Renal Complications," by Dr. F. Giugni, pp. 92–104 ; " Complications of the Blood and Blood-forming Organs," by Professor U. Gabbi, pp. 105–107 ; " Complications of the Nervous System," by Dr. Paolo Magaudda, pp. 107–110.

It is impossible to review these papers in any detail here.

La Cava (F.), pp. 111–113 and *Malaria e Malat. d. Paesi Caldi*, 1914, Sept.-Dec. Vol. 5. Nos. 5–6, pp. 367–370.

The author discusses the treatment of oriental sore, and points out that the best type of healing is obtained by the natural process of recovery, and furthermore such healing renders the individual immune, whereas surgical interference may result in severe scarring, and leave the individual liable to further infection. Treatment of such a benign disease by the intravenous injection of dangerous drugs like salvarsan, neosalvarsan, or tartar emetic can hardly be justified. It is best to treat with ointment and dressings, to maintain ordinary cleanliness and to brush over lightly with tincture of iodine.

Giugni (F.), p. 114. With 2 coloured plates.

The author records his successful culture of *Leishmania tropica* from three cases of oriental sore in Italy. The margins of the ulcers were sterilised with tincture of iodine, and the material obtained through these margins for inoculating tubes of N.N.N. medium.

Ranieri (G.), p. 115.

The author mentions the case of a dog which belonged to a family in Campo Calabro, and showed signs of leishmania infection. Puncture of the liver performed by Dr. Giugni revealed typical leishmania. It is interesting to note that no case of the disease in a child occurred anywhere in the near vicinity of this dog's haunts, a fact which bears out the view of Gabbi and Spagnolio that it is only exceptionally that the disease in children is closely associated with the similar disease in dogs. This association has only been definitely established in five out of about five hundred cases diagnosed. C. M. Wenyon.

LAVERAN (A.). **Les Leishmanioses chez les Animaux.**—*Ann. Inst. Pasteur.* 1914. Sept.-Oct. Vol. 28. No. 9-10. pp. 823–838; Nov.–Dec. No. 11–12. pp. 885–912; Jan. Vol. 29. No. 1. pp. 1–21. With 1 text fig.; Feb. No. 2. pp. 71–104. With 2 plates and 2 figs.

This is a long paper on the subject of leishmania in animals and, being a complete account of experimental work hitherto done, is of great value to those working at this branch of leishmaniasis.

There are four sections :—(1) The natural leishmaniasis of dogs; (2) Experimental infections due to *Leishmania infantum*; (3) Experimental infections due to *Leishmania donovani;* (4) Natural and experimental infections due to *Leishmania tropica.* The paper itself is a resumé, so cannot be reviewed in any detail here. Those interested must refer to it for further particulars.

The author's general conclusions are as follows :—

Natural canine leishmaniasis, which occurs in all those regions in which Mediterranean kala azar is endemic, displays the closest resemblance as regards symptoms and pathological lesions to the experimental disease which can be produced in dogs by inoculating them with *Leishmania infantum* of human origin. The parasites seen in the natural canine disease cannot be differentiated from those of the human disease. There is therefore every probability that the two diseases, human and canine, are one. There are, however, some points of obscurity : there is great irregularity in the incidence of canine and human leishmaniasis; also it is rarely that dogs suffer from the disease in houses in which human beings are infected; further, the Indian kala azar is inoculable, though with slightly more difficulty, into dogs, yet no cases of the canine disease have been discovered in the great endemic centres in India, in spite of most careful search.

Dogs, monkeys and white mice can all be successfully inoculated with both *L. donovani* and *L. infantum,* and the same methods of inoculation are applicable to both viruses, which produce identical symptoms in these animals though the Indian virus is less virulent to dogs, while purely local cutaneous lesions resembling oriental sore have been produced in monkeys by means of the Indian virus, though as yet not with the Mediterranean virus.

A *Macacus cynomolgus* which had an immunity against the Mediterranean kala azar was found to be immune also to the Indian virus, while a control monkey was easily infected. Cutaneous lesions due to leishmania have been described in dogs. These appear to be *L. tropica.* It has yet to be determined whether the leishmania of South American dermal leishmaniasis is a distinct species or merely a variety of *L. tropica.*

Leishmania tropica is inoculable to dogs, monkeys, white mice and other small rodents. It produces usually purely local lesions, as in dogs and monkeys, which have a close resemblance to oriental sore in man. In mice, however, by intravenous or intraperitoneal inoculations, there is often a general infection without any local lesion, like that produced by injection of *L. infantum* or *L. donovani.* On the other hand, as in some cases with the virus of Indian kala azar purely local skin lesions, like oriental sore, are produced in monkeys without

any general infection, one has the right to ask if *L. tropica* is merely a variety of *L. donovani* or *L. infantum* which has adapted itself to different conditions of life and transmission.

Very little has been done on the possibility of conferring immunity against kala azar by *L. tropica* injections, and vice versa. Further work must be carried out with the flagellates of lizards and of the blood-sucking flies with a view to clearing up some of the obscurity which invests the subject of the etiology of the leishmania infections.

C. M. W.

Row (R.). **Experimental Leishmaniasis in the Monkey and the Mouse induced by the Parasites in Culture.**—*Indian Jl. Med. Research.* 1914. Apr. Vol. 1. No. 4. pp. 617–621. With 2 coloured plates.

The paper describes firstly kala azar culture experiments. The success or failure of inoculation depends on three factors: (1) The susceptibility of the animal; (2) the age and particular morphological phase of the parasite in culture; and (3) the mode of injection. The monkey *Macacus sinicus* is the most suitable animal for experiment, especially the small race found in the vicinity of Madras. The author has found dogs to be completely refractory to cultures, though Laveran, with the same culture strain, successfully infected three out of eight dogs in Paris. Positive results either local or general are obtained only when the cultures abound in small rounded bodies resembling the original parasite, or small dots quite distinct in shape from these and looking like the fused condensed nuclei of the parasites enveloped in a mere suspicion of body protoplasm.

Intraperitoneal injection, if successful, always yields a generalised infection, while a subcutaneous injection may produce a localised nodule, or a generalised infection or both. In mice subcutaneous or intraperitoneal injections give rise to general infections. In the latter case the incubation period averages $5\frac{1}{2}$ months instead of over 9 months when subcutaneous injections have been made.

Macacus sinicus, large variety, becomes locally infected with a localised nodule in $3\frac{1}{2}$ to 5 months after subcutaneous injection. In the small variety a local nodule appeared after 5 months followed by a general infection in 9 months in one case, and a general infection only after 5 months in another case.

The second part of the paper is devoted to experiments with the cultures of the parasite of oriental sore. Though Nicolle, Manceaux and Laveran have obtained a lesion in the monkey by use of cultures, the author has constantly failed with monkeys. A mouse, however, was repeatedly injected with cultures of *Leishmania tropica*. The animal was killed, apparently in good health, $9\frac{1}{2}$ months after the first injection. The spleen was enlarged, while smears of this organ, the liver and the bone marrow showed a very heavy leishmania infection.

Mention is made of coccus-like bodies in the red cells of the heart blood and the author asks the question, "Could these be a 'pre-parasite' phase of the leishmania?"

C. M. W.

PAVONI (Giovanni). **Contributo allo Studio della Infezione Sperimentale del** *Mus musculus* **con** *Leishmania tropica* **e** *infantum.*—*Pathologica.* 1915. Mar. 1. Vol. 7. No. 152. pp. 114–116.

The author has inoculated mice either intravenously or intraperitoneally on a large scale with both *Leishmania tropica* and *L. infantum* in culture in N.N.N. medium. With *L. infantum* he has infected 32 mice and with *L. tropica* 6. In two of the *L. infantum* mice and one of the *L. tropica* mice, there developed skin lesions like those obtained by GONDER in his experiments with *L. tropica* and mice (this *Bulletin*, Vol. 2, p. 449).

One of the *L. infantum* mice 80 days after inoculation developed a swelling of the right cheek. This extended over the ear and there appeared a few days later a swelling around the anus and root of the tail. Liquid aspirated from these swellings showed leishmania. Ten days later the swellings ulcerated with a tendency to necrosis. In scrapings from these ulcers leishmania in small numbers were found. The ulceration extended somewhat during the next few days. The animal became cachectic and died on the 98th day. There was marked enlargement of the spleen and liver, which were infected with leishmania. The second of the *L. infantum* mice which developed skin lesions showed on the 95th day swelling of both cheeks with a later extension of this round the neck and ears, while oedema round the anus appeared. These lesions followed the course of those in the first mouse and contained numerous leishmania. The animal died on the 121st day. The liver and spleen both contained leishmania and were six to eight times the normal size. In the *L. tropica* mouse with skin lesions these appeared on the 92nd day and were of the same kind as those in the *L. infantum* mice. The mouse died on the 129th day with very large liver and spleen which harboured leishmania.

The other mice infected with *L. infantum* and *L. tropica* did not develop skin lesions, but they all during the second and third month began to suffer from loss of hair and had large livers and spleens which were found to contain leishmania.

These results not only confirm those of GONDER on the production of skin lesions in mice with *L. tropica* infections, but show that similar skin lesions develop in a certain number of cases with *L. infantum* infections. Taking into consideration these results, and the fact that *L. tropica* and *L. infantum* develop indistinguishable antibodies, and that rabbits immunised against both forms of leishmania when tested with kala azar antigen (extract of spleen, or culture) possess specific though indistinguishable amboceptors, one is compelled to consider the possibility of the unity of the infective agents in Indian kala azar, infantile kala azar and oriental sore. C. M. W.

BARBARA (Mario). **Per la Identificazione della** *Leishmania tropica* **(Bottone d'Oriente) con quella del Kala-Azar.**—*Ann. Med. Nav. e Colon.* 1914. Dec. Ann. 20. Vol. 2. No. 6. pp. 554–559.

The paper is a lengthy discussion upon the relation of *Leishmania tropica* to *Leishmania donovani*, based on the results of experimental inoculations which have been performed by other observers on man and animals. C. M. W.

Kala Azar.

Mackie (F. P.). **Kala-azar in Nowgong (Assam).**—*Indian Jl. Med. Research.* 1914. Apr. Vol. 1. No. 4. pp. 626–662. With 6 maps and 6 charts.

Kala-azar in Assam. Précis of a Progress Report—Feb. to Sept. 1913.—*Proc. Third All-India Sanit. Conference held at Lucknow* Jan. 19–27. 1914. Vol. 5. Papers. Suppl. to *Ind. Jl. Med. Research.* pp. 12–14.

This is a long paper on the investigation of kala azar in the Nowgong district of Assam. The disease was introduced from Goalpara in the west in 1891 and spread rapidly eastward. The rise and fall of the disease has been studied month by month and *manza* by *manza* from the year 1891 to the present time. Two maps illustrate the population changes—the first, the decrease during the period 1891–1901, this being almost entirely due to kala azar ; the other the recovery of the population during the succeeding ten years. At the present time, however, there is a general belief amongst the villagers that the disease is becoming more prevalent. The distribution of kala azar in the district is illustrated by a series of maps on which the actual cases are marked by red dots.

A special study was made of the Nowgong municipality. The population investigated numbered 4,778 persons, of which 27 suffered from " positive " kala azar, 21 were suspicious, and 64 deaths from the disease were reputed to have occurred during the last few years. One interesting point was revealed by this investigation, namely, that no case was found amongst the Jain community, which numbers about 200, and it could not be discovered that any case had occurred amongst them. A paragraph each is devoted to the question of Meteorological Conditions of Nowgong, Malarial fever and Enlargement of the Thyroid.

In the section devoted to clinical observations the age distribution of 195 persons suffering from certain kala azar is given as between 1 and 5 years 1 case, between 6 and 10 years 100 cases, between 11 and 15 years 49 cases, between 16 and 20 years 17 cases, between 20 and 30 years 12 cases, and over 31 years 8 cases. About half the cases gave a fairly clear history of kala azar, either in the household or among their relatives within five years. The appearance of kala azar in a village could generally be traced to the coming of an infected person from another village, and if the disease spread, it did so only amongst those brought into intimate personal contact with the new arrival, and the conditions almost always pointed to a personal rather than to a house infection. On the other hand, the author has been struck by the frequency with which one sees a case of advanced kala azar, who has for months, or perhaps years, lived in the utmost intimacy with his brothers and sisters, but where the latter show on examination no sign whatever of the disease.

A section of the paper is devoted to noteworthy cases. Two cases were treated with a mixed streptococcus and pneumococcus vaccine, another with salvarsan and vaccines and one with neo-salvarsan alone. There was no improvement in these cases. In an early case in a boy of 11 years parasites were found in the peripheral blood in

small numbers at the fourth month of the disease. Another case of a man, age 25 years, is described as illustrating how ankylostomiasis may simulate kala azar. In one case, a woman age 17 years, death resulted from rupture of the spleen as a result of a fall. Finally a case is described in which the parasites in the peripheral blood and in the organs appeared to be undergoing dissolution at the time of death. The patient was suffering from cancrum oris at the time. In the peripheral blood shortly before death, and in the organs removed half an hour after death, the parasites appeared to be disintegrating. A puppy, however, contracted the disease after injection of spleen emulsion.

Under Laboratory Work it is stated that, excluding doubtful cases, leishmania were found in the peripheral blood of 35 out of 166 cases, or 21 per cent.

The following is a summary of animal experiments :

Monkeys.	*Leishmania.*		
	+	—	Total.
By peritoneal route ..	2	3	5
By mouth route		2	2
Still under observation ..			7
Flying Foxes.			
By peritoneal route ..	2	2	4
Other routes		2	2
Still under observation ..			4
White Mice.			
By peritoneal route ..	3	8	11
White Rats.			
By peritoneal route ..		7	7
Still under observation ..			4
Other Animals.			
Peritoneal route (cat) ..		1	1
Dogs under observation			2

During seven months 6,672 fly papers were placed in kala azar houses or in the hospital wards. The catch of insects was singularly small, and the biting ones were chiefly sand-flies (*Phlebotomus* sp.), species of Culex, and a few ticks and fleas. The insects caught were dissected, but with the exception of the sand flies none were found to contain flagellates. A herpetomonas was found in a certain percentage of sand flies. [A herpetomonas was described by WENYON in the Phlebotomus of Aleppo. *Jl. Lond. School Trop. Med.* March, 1912. Vol.I, Pt. ii. p. 98.] Some batches of anopheles were fed on patients with parasites in the peripheral blood, but no development was observed. No flagellates were found in 122 fleas taken from emaciated dogs in kala azar villages, nor was anything discovered in 100 ankylostome worms taken from the faeces of kala azar patients. A total of 469 bugs taken from the bedding of positive cases of kala azar, and 191 laboratory bred bugs which had fed on kala azar cases with parasites in the peripheral blood were dissected and 209 were injected into the peritoneal cavity of a monkey. No leishmania were found in any of the bugs and the monkey did not become infected.

Ninety-three dogs have been killed in villages and houses where kala azar is prevalent. The spleen and the bone marrow of all these dogs were carefully examined and no infections noted. Injection of marrow of some of these dogs into monkeys, flying foxes and dogs has, so far, not given any result. Reference is made to the negative examination of fish from the river Kallany and of 69 leeches which had fed on kala azar patients. The discovery of small bodies in the faeces of some kala azar cases is mentioned in another paper reviewed in this number.

C. M. W.

Mackie (F. P.). **The Progress of Kala-Azar in a Localised Community.** —*Indian Jl. Med. Research.* 1914. Oct. Vol. 2. No. 2. pp. 505–509.

This paper has to do with kala azar in the Dudnai Thana of Goalpara District at the foot of the Garo Hills. Investigations carried out by the author have shown that in this, the oldest focus of the disease in Assam, kala azar is still smouldering. In January, 1914, 61 cases were found in twelve villages, and during the previous twelve months there had been 28 deaths and 24 new cases. A table and a map show in graphic form the progress of the disease between January, 1913, and January, 1914.

C. M. W.

Young (T. C. McCombie). **Report on the Progress of the Kala-Azar Investigation during the Season 1912-13.**—*Proc. Third All-India Sanitary Conference held at Lucknow Jan. 19–27.* Vol. 5. Papers. Suppl. to *Indian Jl. Med. Research.* pp. 21–44. With a map.

This is a long paper which is chiefly of local interest and has to do with the distribution of kala azar in Assam. There is undoubtedly a consensus of opinion, particularly in the Nowgong district, that in certain areas the disease is showing increased activity of late years. During the 20 years under review the totals for the Assam Valley districts seem to have reached their lowest levels in the years 1908 and 1909; thereafter Goalpara shows an increase, the Garo Hills and Kamrup remaining about the same level. Darrang shows a decrease, Nowgong an increase, Sibsagar a few cases and Lakhimpur a few cases upon tea estates. There is thus no important change in the general district mortality from kala azar. Still, the author is inclined to think that the popular ability to diagnose kala azar is tolerably reliable and the opinion of the villagers correct, but there is a tendency to an increase of the activity of the disease in certain areas.

The paper is illustrated by several charts and tables, into which it would be unprofitable to enter here. Those interested in the details must refer to the original paper.

[See paper by same author reviewed in this *Bulletin*, Vol. 2, p. 433.]

C. M. W.

ARCHIBALD (R. G.). **A Preliminary Report on some Further Investigations on Kala Azar in the Sudan.**—*Jl. R. Army Med. Corps.* 1914. Nov. Vol. 23. No. 5. pp. 479–495.

The Sudan Kala Azar Commission was closed in 1913, and the investigations were continued at Khartoum. It was found there that the following animals could be infected :—The grey monkey (*Lasiopyga callitrichus*), the jerboa (*J. gordoni*), the gerbil (*G. pygardus*) and the dog (*C. domesticus*). In the gerbil and jerboa the disease appears to run a chronic course in no way impairing the health of the animals.

Cultures.—Tests were made of the effect of sunlight, temperature, ·2 per cent. hydrochloric acid, tap water, distilled water, river water and Bacillus coli on the cultures of the parasite of Sudan kala azar. The inference drawn is that the cultural forms are possessed of greater vitality than they are given credit for in other countries. Under unfavourable conditions, short of immediate death, the flagellates tend to revert to a cystic stage in which, possessed of thicker walls, they are apparently endowed with greater vitality and powers of resistance. Inoculation experiments with cultures performed intraperitoneally resulted in the infection of the grey monkey and the jerboa. Attempts to infect a monkey by feeding with the faeces of a kala azar patient gave negative results.

Infection by feeding. Two grey monkeys were made to ingest infected kala azar material, in one case from another infected monkey and in the other from a fatal case of kala azar. Care was taken to place the material far back in the throat of the animals so that it was prevented from coming in contact with the front part of the mouth. The animal fed on the monkey material became ill and was killed 36 days after feeding. No leishmania could be found but 2 c.c. of spleen and liver emulsion were injected intraperitoneally into another monkey which became infected. The monkey which was fed on the human material became infected and parasites were demonstrated by liver puncture 132 days after feeding. This is the first record of infection of an animal by feeding on infected material.

An attempt was made to infect a healthy pup by feeding, but though the animal showed signs of anaemia and emaciation when killed on the 162nd day, no leishmania could be found. The liver, however, showed oval and round cells containing coccal bodies similar to those described by the author and by SMALLMAN in certain cases of kala azar. Reference is made to WENYON'S statement that he had found the bodies in the livers of uninoculated dogs and rats [this *Bulletin*, Vol. 3, p. 551.] The author remarks that it is strange that he has not encountered them in uninoculated animals in several hundred examinations carried out in the Sudan during the last six years. He says that CHALMERS has recently observed them in the lung of a gerbil previously inoculated with a human trypanosome and a homologous immune serum, and that they have been obtained from the liver of kala azar cases recently. The author is inclined to consider the bodies of protozoal origin, and in some ways closely associated with leishmania. [A paper by SCORDO on this subject is reviewed below.] Attempts to infect a pup by feeding on cultures of leishmania, and a monkey per vaginam, failed. Cultures placed on fresh skin abrasions on a monkey produced no infection.

Other points of interest in the paper are these :—

Human blood serum has an almost immediate destructive effect on cultures of *Leishmania donovani*. Specific agglutinins are not present in the serum of patients suffering from kala azar. Kala azar may occur as a concomitant infection with filariasis. Epidemiological and experimental evidence does not support the theory that kala azar in the Sudan is transmitted by a biting insect. A more probable source of infection appears to be some intermediate host whose habitat is in the water. No natural host has been found among the numerous animals examined in the Sudan.

C. M. W.

Bassett-Smith (P. W.). **Discussion on Kala-Azar or Parasitic Splenomegaly and Allied Infections.** [Eighty-Second Annual Meeting of British Medical Association, Section of Tropical Medicine.]—*Brit. Med. Jl.* 1914. Dec. 19. pp. 1058–1060.

This paper contains a concise summary of our knowledge of diseases due to the parasite leishmania. Mention is made of a case of kala azar in an adult aged 29 years, the disease having been contracted at Malta in 1911. [See this *Bulletin*, Vol. 3, p. 133.] The disease was diagnosed 14 months after he had left the island, in March, 1913. The patient was treated by intramuscular injections of atoxyl (3 to 5 grains) twice a week, and by some injections of an autogenous vaccine prepared from cultures of his own flagellates. After four and a half months' treatment leishmania could not be found by liver puncture though they were still present in the spleen. After 12 months they were present in small numbers in the spleen, but did not develop in N.N.N. medium. At the time of writing the patient's clinical picture was not much improved, the liver and spleen having remained large and the leucopenia marked. In a footnote added later it is stated that the patient had been discharged from hospital and had regained his former weight ; the blood picture was almost normal, the liver and spleen were smaller and there had been no fever for three months.

In a discussion following the reading of this paper, Professor Gabbi relates how he had failed to bring about the infection of two puppies which were made to live with an infected bitch for several months and, further, to infect two young puppies by placing on them fleas from an infected dog. These experiments give no support to Basile's flea theory of transmission. [In the report of Professor Gabbi's remarks the name of the flea is stated to be *Ceratophyllus fasciatus*, the rat flea. This is incorrect, and should be *Ctenocephalus canis*, the dog flea.]

Dr. Bahr drew attention to the absence of human and canine kala azar in Ceylon, and Professor Ferguson to a form of splenomegaly in Cairo which was not of leishmania origin. He remarked that it was curious that though kala azar was absent from Egypt, cutaneous leishmaniasis was common enough in the Nile Valley. Professor Gabbi said he had seen cases of this type of splenomegaly in Sicily.

C. M. W.

Spagnolio (Giuseppe) & Giugni (Francesco). **Stato presente del Problema della Trasmissione della Leishmaniosi Interna nei Paesi del Bacino Mediterraneo. (Rivista sintetico-critica.)**—*Malaria e Malat d. Paesi Caldi.* 1914. May–June. Vol. 5. No. 3. pp. 204–211; & July–Aug. No. 4. pp. 297–305.

A note on the first two sections of this contribution appeared in this *Bulletin*, Vol. 4, p. 395. Section 3 is a continuation of the review on the flea transmission hypothesis. The authors come to the conclusion that the absolute demonstration of the transmission of kala azar by means of human and dog fleas is lacking, and that the earlier supposed successes were due to failure to control the presence or absence of leishmania in the organs by the culture method when simple microscopic examination was negative. Liver puncture even may be no indication of an infection, as parasites may be absent in this organ and present in others.

C. M. W.

Patton (W. S.). **The Examination of the Peripheral Blood of 84 Patients suffering from Kala-Azar at the General Hospital, Madras, during the Period from 15th June 1912 to 15th July 1913.**—*Indian Jl. Med. Research.* 1914. Oct. Vol. 2. No. 2. pp. 492–504.

This paper contains a record of the author's experience of the examination of the peripheral blood of cases of kala azar for leishmania in stained films. Of the 84 cases examined the parasite was found in the first blood film in 42 cases, in the second in 13 cases, in the third in 12 cases, in the fourth in 5 cases, in the fifth in 2 cases, in the sixth in 4 cases, in the seventh in 1 case, in the eighth in 1 case, in the ninth in 2 cases, in the seventeenth in 1 case, and in the twentieth in 1 case. Many of the patients were clearly in the early stage of the disease.

C. M. W.

Saito. **The Clinical Observation of the Kala-Azar in a Chinese Child.**—*Sei-i-Kwai Med. Jl.* 1915. Jan. 10. Vol. 34. No. 1. (Whole No. 395), p. 2. (The Original in No. 22, Vol. 28 of the *Jl. Tokyo Med. Assoc.*).

The record of a fatal case of kala azar in a Chinese child aged 3 years and 5 months. Leishmania were always present in nine different punctures of the spleen in spite of treatment with neo-salvarsan (total quantity 0·35 gram). The locality is not mentioned in the paper, which is a review of the original article.

C. M. W.

Reed (Alfred C.). **Kala-Azar. A Case Report from China.**—*Jl. Amer. Med. Assoc.* 1914. Oct. 31. Vol. 63. No. 18. pp. 1572–1573.

The paper records a case of kala azar in a Chinaman aged 28, who appears to have contracted the disease near Ichang on the Upper Yangtse River less than a year before coming to the Red Cross Hospital at Changsha, the capital of Hunan, which is 200 miles south and west of Hankow.

It is interesting to note that the disease was finally diagnosed by the discovery of leishmania within a leucocyte from the peripheral blood, and that both Ichang and Changsha are well outside the district described by COCHRAN as the endemic area for kala azar in China [this *Bulletin*, Vol. 3, pp. 130–131].

C. M. W.

LIGNOS (Antoine). **Quelques Nouveaux Cas de Guérison de Kala-Azar Infantile observée à Hydra.**—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 25–28.

Four further instances of recovery from infantile kala azar are recorded from Hydra for the year 1912. This brings the total of recoveries in this island to 24 out of 100 cases diagnosed by spleen puncture during the years 1910–1912. Recovery is not necessarily limited to mild cases of short duration, for some have recovered after a very severe illness of long duration. The four cases recorded in this paper, ranging in age from 13 to 27 months, are described in some detail. The recoveries do not appear to depend on any special line of treatment.

C. M. W.

GATTI (Giacinto). **Nuovi Casi di Leishmaniosi Infantile osservati a Napoli e Dintorni.**—*Pediatria.* 1914. Nov. Vol. 22. No. 11. pp. 834–849.

This paper is a record of sixteen cases of infantile kala azar which have been seen by the author in and around Naples. Parasites were sought for in the peripheral blood of ten of these cases with a positive result in every one. In one case parasites were successfully cultivated from the peripheral blood. All the cases were diagnosed by spleen puncture.

C. M. W.

DI GIORGIO (G.). **A Proposito di 41 Casi di Leishmaniosi Infantile osservati nella Clinica Pediatrica di Palermo durante l'Anno Scholastico 1912–1913.**—*Gaz. Internaz. d. Med. Chirurg. Igiene.* 1915. Jan. 9. No. 1. pp. 4–10, & Jan. 16. No. 2. pp. 24–28.

The paper contains short notes on 41 cases of infantile kala azar observed in the clinic for children's diseases at Palermo during the years 1912–1913.

C. M. W.

IOANNIDES (George S.). Τὸ καλα-αζὰρ ἐν Ἑλλάδί. Παρατήρησις πέντε περιπτώσεων. —[Kala Azar in Greece.]—„Ἰατρικὴ Πρόοδος." 1914. Oct. 1 & 15. Vol. 19. No. 19 & 20. pp. 362–363.

The attention of Greek practitioners has of late years been drawn to the frequency of this disease in Greek territory. The author of the present paper furnishes brief notes of five cases in children of ages varying from 1 to 5 years, and expresses the opinion that the disease is much more common in Greece than is generally thought. The blood, obtained by spleen puncture, should always be examined microscopically in doubtful cases in order to confirm the diagnosis.

J. B. Nias.

KATSAS (Gregory G.). Περίπτωσις καλα-αζὰρ μετ' ἀνευρέσεως τῶν παρασίτων ἐν τῷ περιφερικῷ αἵματι. [Case of Kala-Azar with Discovery of Parasites in the Peripheral Blood.]—„'Ιατρικὴ Πρόοδος." 1914. Oct. 1 & 15. Vol. 19. No. 19 & 20. pp. 360–362.

An account of a case of kala azar in a girl of 6 years of age, who had spent all her life in the middle of Athens. The infection was probably derived from a dog with which the child had been in the habit of playing about a year before, and which had suffered from ulcers of the skin, loss of hair and diarrhoea. Unfortunately, the dog was dead at the time when the child commenced to develop symptoms so that an examination of its blood was not possible. A full account of the microscopic appearance presented by the child's blood is given; leishmania were discovered in a film of finger blood, so that there was no doubt about the diagnosis. J. B. N.

DI CRISTINA (G.) & CARONIA (G.). **Sulla Terapia della Leishmaniosi Interna.**—*Pathologica.* 1915. Feb. 15. Vol. 7. No. 151. pp. 82–83, & *Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 63–66.

Sulla Terapia della Leishmaniosi Interna. (Nota preventiva.)—*Pediatria.* 1915. Feb. Vol. 23. No. 2. pp. 81–92.

Following the publication by Gaspar VIANNA of cases of dermal leishmaniasis in South America successfully treated by intravenous injections of tartar emetic, the authors experimented with this treatment in cases of infantile kala azar. The results they obtained were so encouraging that they were led to publish this note in the hope that others would give the method a trial.

The treatment consists in the intravenous injection of a 1 per cent. watery solution of antimony tartrate on alternate days. They commence with a minimum dose of 2 centigrams and increase to a maximum of 10 centigrams. The vein employed is one at the bend of the elbow, or the external jugular or temporal. By employing a very fine needle it is possible to use the same vein repeatedly.

Ten cases have been so treated. Two, which were in the final stage of the disease, can hardly be considered and died at the commencement of the treatment. One other died of acute nephritis; it is unlikely that this was the result of the treatment as the child had a smaller dose than others which had no renal trouble. Of the seven remaining cases, five are pronounced cured and two are progressing towards recovery. The following table sets forth the features of the eight cases.

Number of case.	Age.	Duration of illness.	Duration of treatment.	Total amount of drug used.	Result.
1	m.15	months 5	days 20	centigrams 35	cured
2	y. 6	„ 8	„ 20	„ 84	„
3	m.20	„ 4	„ 13	„ 25	died of nephritis
4	y. 2	„ 5	„ 40	„ 40	cured.
5	y. 2	„ 3	„ 20	„ 25	„
6	y. 1	„ 2	„ 40	„ 35	„
7	m.20	„ 3	„ 20	„ 26	recovering.
8	m.17	„ 5	„ 10	„ 6	„

C. M. W.

YOUNG (W. McCOMBIE). **Segregation and Kala-Azar. A Useful Measure.**—*Indian Med. Gaz.* 1914. Aug. Vol. 49. No. 8. pp. 301–303.

A paper on this subject by Dr. Dodds PRICE and Sir Leonard ROGERS [see this *Bulletin*, Vol. 3, pp. 552–554] has led the author to publish an account of his similar experiences amongst the indigenous Assam population of the Golaghat subdivision of the Sibsagar district. In 1909 kala azar was found to have spread from the neighbouring district of Nowgong into some of the villages of Sibsagar. Major CHRISTOPHERS subsequently investigated this outbreak and observed that, though there was then no great tendency to spread, there was danger so long as the foci existed. Later the number of infected villages was ascertained by inspection, and there were put into force segregation measures, the success of which the author records in this paper. The infected homes were dealt with in this way. A new house was supplied and the family was removed there, a separate sleeping apartment outside being provided for the infected members. The old house was burnt down, and with it the bedding, clothing and other belongings which could presumably harbour insect parasites. Liberal compensation was paid by the Government for such loss.

The consequence of these measures has been that out of forty families removed to new sites three years ago a recurrence of the disease in a person not obviously infected upon the old site has occurred in only one case. The people appear to recognise the value of the measures and are grateful to Government for carrying them out.

The results appear to show that the measures successfully employed by Dodds PRICE and ROGERS in combating the disease among the labour force of a tea garden can be applied equally well to the indigenous population.

C. M. W.

ROGERS (Leonard). **The Bearing of Assam Tea Garden Experience on the Problem of the Etiology of Kala-Azar.**—*Proc. Third All-India Sanitary Conference held at Lucknow. Jan. 19–27. 1914.* Vol. 5. Papers. Suppl. to *Indian Jl. Med. Research.* pp. 15–20.

A paper on this question by the author was reviewed in this *Bulletin*, Vol. 3, pp. 552–554. The subject matter of the two papers is essentially the same.

C. M. W.

SCORDO (F.). **Sulla Pretesa Identità della Leishmania hominis e della Leishmania Canis.**—*Malaria e Malat. Paesi Caldi.* 1914. July–Aug. Vol. 5. No. 4. pp. 265–271.

The relation of the human to the canine kala azar was tested by the author by experimenting on the action of the serum of cases of kala azar on cultural forms of leishmania of human and canine origin. A preliminary test was conducted by observing two hanging drop preparations made by adding to two loops of culture one loop of serum of a case of kala azar. During one hour's observation the human and canine cultures behaved in much the same way. Other dilutions were tried and cultures of varying ages used but no definite differences in behaviour could be determined.

A second test consisted in adding to culture tubes of leishmania varying quantities of kala azar serum. The cultures were examined at intervals during 24 hours. These observations showed that, on the whole, the leishmania of human origin compared with that of canine origin had a lack of motility and a greater tendency to clumping of the parasites. These differences were most marked during the first hour of observation. Subsequently the contrast became much less marked.

The third test was carried out by adding two drops of kala azar serum to tubes of N.N.N. medium before their inoculation with leishmania. In four of these tubes inoculated with leishmania of human origin there was no growth on the fourth day, whereas in those inoculated with canine leishmania there was definite though somewhat limited growth.

The experiment was repeated on a larger scale by employing the serum of six cases of kala azar in children and controlling the result by using the serum of healthy dogs. A series of small serum-reaction tubes was used, and in these were placed 2, 3, 5 or 10 drops of culture of leishmania, either human or canine. To each series of tubes was added a drop of kala azar or canine serum. The tubes were incubated at 24°C. and observed from time to time. Generally speaking the series of tubes to which the human serum had been added showed a more conspicuous tendency to agglutination on the part of the human leishmania than the canine leishmania. With the canine serum the action was much less marked, though still the human cultures tended to agglutinate more than the canine.

These results show that the serum of kala azar patients has some agglutinating action on culture of leishmania, and that this action is more on the cultures of human than of canine origin.

C. M. W.

Scordo (Francesco). **Intorno alla Natura di Certi Corpi Granulari recentemente descritti nella Leishmaniosi.**—*Malaria e Malat. d. Paesi Caldi.* 1914. July–Aug. Vol. 5. No. 4. pp. 272–276.

The author refers to the question of the nature of the cytoplasmic bodies containing various shades of red staining granules which are sometimes seen in smears of organs of kala azar patients, and which were first described by Archibald, and later by Statham and Butler, and Smallman. A paper by Wenyon on the nature of these bodies was reviewed in this *Bulletin*, Vol. 3, p. 550. The writer of the paper under review points out that he called attention to these bodies in an earlier illustrated paper (*Malaria e Malattie dei Paesi Caldi.* Aug. 1913), in which he showed that frequently within the large mononuclear cells the leishmania undergo degeneration, leaving embedded in the cytoplasm only granular remnants which stain red. He now discusses his observations in further detail and agrees that in smears of organs portions of the cytoplasm of large cells become broken off. If these large cells have a granular cytoplasm then, as Wenyon has pointed out, these isolated masses of cytoplasm contain the same granules. In cases of leishmania infection, portions of cytoplasm containing leishmania are broken off. Similarly, when the leishmania

have degenerated within the cytoplasm of the large cells, the separated cytoplasmic masses contain, instead of typical leishmania, only the granular remnants of these.

The author points out that some, at least, of the bodies seen in leishmania infections may be produced in this way, and be actually connected with the leishmania not, as ARCHIBALD has maintained, in a developmental manner, the bodies representing schizonts, but as degeneration products. In other cases he admits that the bodies have been derived from large cells filled with granules, which are not in any way parasitic.

C. M. W.

MACKIE (F. P.). **Note on some Bodies of Unknown Nature found in the Faeces of Kala-Azar Patients.**—*Indian Jl. Med. Research.* 1914. Oct. Vol. 2. No. 2. pp. 510–515. With a map and 1 coloured plate.

The author writes that on several occasions he has found in the dejecta of patients, single, paired, or sometimes a small group of bodies which, in size and general morphology, were indistinguishable from leishmania, with such modifications as one might reasonably expect these bodies to assume in faeces. In these few isolated cases the suspicious bodies were generally lying in or on a small mass of mucus in which, it may be, they were protected from the action of bacteria. Special stress is laid on the examination of faecal mucus passed during dysenteric attacks in kala azar patients with the result that these bodies were found. In order to examine the mucus, croton oil was first administered and flakes of the resulting mucus from the stool were subject to microscopic investigation. Eighty-two cases were examined with discovery of the bodies in large numbers in eight, and in small numbers in another eight. The faeces of twenty-six healthy persons examined after croton oil treatment were negative. By way of tracing some connection between these bodies and leishmania feeding experiments with monkeys and dogs were undertaken. The results have been, so far, negative.

As the author remarks, it is difficult to give an idea of these bodies by written description. They are illustrated in a coloured plate. In size they vary from 2μ to 4·5μ diameter, almost invariably possess one large uniformly staining nucleus, and often a small azurphile nodule generally placed close to the margin. There is always a definite cell wall generally seen as a clear margin, but sometimes of double contour. The cytoplasm is either hyalin, or contains certain small chromatin dots, or is marbled or purely vacuolated. The specimens were submitted to Prof. MINCHIN whose remarks upon them are reproduced in the paper.

The author does not wish to appear dogmatic over the question of these bodies, for he writes that he is quite prepared to find that they are of other origin.

[In a paper entitled, "*Beitrag zu Kenntnis der Blastomykosen*" in *Central. f. Bakt.* Bd. 67. 1912, p. 233, [see this *Bulletin*, Vol. 1,

p. 642], da Rocha-Lima goes into the question of the resemblance of certain Blastomycetes to leishmania in dried Romanowsky stained films. He shows that these yeast-like cells often contain two bodies like nuclei, one large and the other small. The large red staining body is not a nucleus. A comparison of the figures of da Rocha-Lima with those of Mackie would suggest that the latter is possibly dealing with similar yeast-like organisms.]

C. M. W.

Giugni (Francesco). **Sulla Presenza della *Leishmania donovani* e lo Sviluppo Colturale dal Sangue Periferico nel Kala-Azar.**—*Pathologica.* 1915. Feb. 15. Vol. 7. No. 151. pp. 84–87, and *Malaria e Malat d. Paesi Caldi.* 1915. Jan.–Feb. Vol. 6. No. 1. pp. 16–20.

This paper has to do with the culture of leishmania from the peripheral blood of cases of kala azar. A paper by the author on this subject was reviewed in this *Bulletin*, Vol. 4, p. 396. He there suggested that the difficulty of culture from the peripheral blood was due to the human blood, which was necessarily present, preventing growth. This view was criticised by Cannata and Caronia (*loc. cit.* p. 397) who likewise cultivated leishmania from the peripheral blood of a case of infantile kala azar. The present paper is a defence by the author of his original position. In the case of two children and a dog which showed leishmania in ordinary blood films repeated attempts at culture failed. This must mean either that successful culture depends on the necessity of there being present in the blood stream not only parasites, but parasites in some particular stage of development; or that culture in some cases is prevented by a condition of the human blood which does not exist in other cases. [In a paper by Gatti reviewed in this number, mention is made of the successful culture of leishmania from the peripheral blood of a case of kala azar.]

C. M. W.

Korke (Vishnu T.). **A Note on the Production of Localised Lesions by *Leishmania donovani* in *Macacus sinicus*.**—*Indian Jl. Med. Research.* 1914. Apr. Vol. 1. No. 4. pp. 622–625.

Experiments were conducted by Row's method of inoculation on monkeys with *Leishmania donovani*. It was found:—

1. In *Macacus sinicus*, *Leishmania donovani* is capable of producing purely localised lesions which take the form of nodules.

2. Injecting infective material into pockets of skin on the foreheads of monkeys is an effectual and easy way of producing such lesions. Such a procedure may at any time give rise to a systematic or generalised infection.

3. The incubation period of these nodules varies between 52 and 71 days.

4. The leishmania contained in such nodules are capable of giving rise to similar lesions in other monkeys.

C. M. W.

Tropical Sore.

Monge M. (Carlos). **La Leishmaniasis del Dermis en el Peru. Espundia, Uta, Juccuya, Qœpo, Tiacc, Araña.**—*Cronica Med.* [*Lima.*] 1914. July 15. Vol. 31. No. 613. pp. 231–235; Aug. No. 614. pp. 251–254; Sept. No. 615. pp. 288–294 and Dec. No. 618. pp. 385–396. With 1 fig.

The author has collected the literature dealing chiefly with the dermal leishmaniasis of South America. The article, as the title indicates, refers more especially to the disease as it exists in Peru, where it is known by the name of Uta, Espundia, Tiacc-araña, Juccuya, Qcepo. The subject is treated at length from every point of view. The following are the conclusions reached by the author :—

1. The disease occurring in various parts of Peru and known under the above names is dermal leishmaniasis.

2. The disease occurs wherever tropical conditions of climate prevail, and tends to limit itself to mountainous regions. Certain clinical types are more common in particular localities; for instance, the mucosal form occurs mostly in forest country.

3. The disease is probably carried by some living creature. In the valley of the Convencion people blame a Simulium.

4. The parasite of the disease is *Leishmania tropica* (Wright). Though flagellate herpetomonas forms occur occasionally, this does not justify the view which supposes a distinct variety under the name of *Leishmania tropica* var. *flagellata* (Escomel, Monge). The occurrence of these forms may be merely an indication of increased virulence.

5. Two types of the disease occur, the dermal and the mucosal.

6. The dermal type may occur in three forms: (*a*) dry nodular form, (*b*) ulcerating form, (*c*) mixed form.

7. The mucosal lesions are always secondary to a primary dermal lesion, the leishmania chancre (*Chancro leishmaniasico*).

8. The clinical history, histopathology, aetiology, and discovery of leishmania demonstrate that these diseases are all dermal leishmaniasis.

9. The view of Escomel that Uta was a form of lupus is disproved by the discovery of leishmania in the lesions.

10. The disease described by Denegri as peculiar to the forest regions of Peru is only the mucosal type of the same disease.

11. The cutaneous lesions respond very readily to treatment with neosalvarsan.

12. The mucosal lesions are at present incurable.

13. Vaccination ought to be employed as a prophylactic against the disease.

14. The best name to employ for this disease in South America is American leishmaniasis.

C. M. W.

Christopherson (J. B.). **On a Case of Naso-Oral Leishmaniasis (Corresponding to the Description of Espundia); and on a Case of Oriental Sore, both originating in the Anglo-Egyptian Sudan.**—*Ann. Trop. Med. & Parasit.* 1914. Dec. 15. Vol. 8. No. 3. pp. 485–496. With 2 plates.

Two cases of dermal leishmaniasis are described, one of the ordinary oriental sore type; the other, on account of involvement of the nasal

and buccal cavities, resembling the South American disease, Espundia. Both patients are said to have contracted the disease in the Sudan, this being the first undoubted record that the disease exists there, for other cases hitherto described appeared to have arisen in Egypt.

The naso-oral case was of a native male, age 40 years, from Wad el Abbas near Sennar town on the Blue Nile, where he had lived for years. The disease commenced two years ago on the upper lip and thence extended into the nose and mouth. The bridge of the nose had fallen in and there was ulceration on the floor of the nose as far back as could be seen—the cartilaginous septum was almost entirely destroyed. There were ulcers on the under aspect of the upper lip; the gums of the upper jaw were swollen and spongy but not ulcerated. The gums surrounding the incisor teeth were ulcerated. Leishmania were found in all the ulcers of the mouth and nose but only in small numbers. There were no enlarged glands and no enlargement of liver and spleen.

The second case is one of the ordinary oriental sore type, there being two sores, one on the metacarpo-phalangeal joint of the right little finger and the other on the skin over the lower end of the right ulnar bone. The patient arrived in Khartoum North in December, 1912, from Egypt, and the sore appeared in July, 1913.

The author mentions another case of the oriental sore type which Chalmers met with from the same district as the first case, which is of interest as being the chief focus of kala azar in the Sudan.

[There seems to be no doubt that the naso-oral case originated in the Sudan, but in view of the long incubation period sometimes noted in this disease the second case might have been infected in Egypt, which was left only six months before.]

C. M. W.

Giuseppe (Mariani). **Contributo alla Conoscenza Anatomo-Patologica della Leishmaniosi Cutanea Mediterranea.—(Bottone d'Oriente),—** *Malaria e Malat. d. Paesi Caldi.* 1914. Sept.-Dec. Vol. 5. No. 5–6. pp. 321–340.

The author describes in great detail the histological changes which take place in the skin during the development and evolution of the cutaneous leishmania affections. He comes to the conclusion that the cutaneous leishmaniases of various parts of the world are histologically identical.

The paper is a long one and must be referred to in the original by those interested in the histo-pathology of oriental sore.

C. M. W.

Mantovani (Mario). **La Leishmaniosi Cutanea a Ravenna.**—*Pathologica.* 1915. Feb. 1. Vol. 7. No. 150. pp. 57–60. With 2 figs.

The record of a case of extensive ulceration of the sole of the right foot which, on microscopic examination, was found to be due to a leishmania infection. The case was of four years' duration and came from Ravenna, this being the first instance of dermal leishmaniasis from this locality in Italy. The condition resisted all treatment.

C. M. W.

VON PETERSEN. **Ueber die Verbreitung der Orientbeule in Turkestan.** [The Diffusion of Oriental Sore in Turkestan.]—*Arch. f. Dermat. u. Syph.* 1914. Vol. 119. Pt. 1. p. 158.

The author has obtained details of 1,200 cases of oriental sore in the Tashkent district of Turkestan. Contrary to the generally accepted view, he finds that the disease first makes its appearance in winter (December and January). The infection is brought about rather by the insects living in the houses than by outside flies. Dogs which suffer from the disease play some part in its spread. The full details of the enquiry will appear in a later paper in the *Archiv für Dermatologie.*

C. M. W.

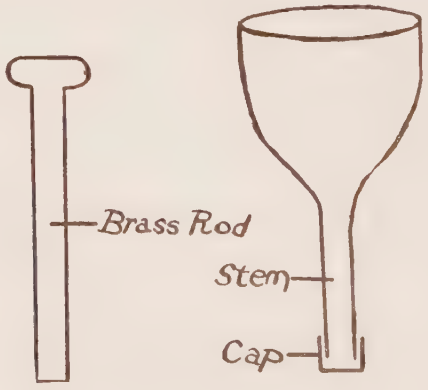
TOMKINSON (J. Goodwin). **Four Cases of Lahore Sore.**—*Brit. Med. Jl.* 1914. Oct. 10. pp. 625–626. With 2 figs.

The author records four cases of oriental sore (Lahore sore) in one family which had resided at Sialkot in the Punjab—the father, two sons and one daughter. The father had a sore on the forehead. All three children had a single sore in the middle of the left cheek and the two sons a sore on the left temple. The three children stated that they habitually slept on the right side, so that it would suggest that inoculation had been brought about by some nocturnal insect feeding on the upturned cheek.

C. M. W.

MITCHELL (T. J.). **Carbon Dioxide Snow with Special Reference to the Treatment of Oriental Sores.**—*Jl. R. Army Med. Corps.* 1914. Oct. Vol. 23. No. 4. pp. 440–446. With 1 diagram and 5 figs.

The author gives an account of his method of treating naevi, warts, sloughing ulcers, ringworm and oriental sore in India, by means of CO_2 snow in the form of a pencil, which is prepared as follows. A cylinder



of CO_2 is obtained from a soda water factory. A tube of blotting paper is made by rolling it round a ruler, the end of the tube is closed by covering it with a towel, while the other end is fitted over the valve of the cylinder and bound on with a bandage. The CO_2 is turned on gently and allowed to pass till the towel feels hard and solid when the CO_2 snow within is removed and placed in a brass mould like a bottle filling funnel with the opening of the tube closed by a cap.

The snow is pushed down into the tube by a brass rod and finally the cap is removed and the pencil of snow pushed out of the tube.

The snow has a temperature of –79° C., and when pressed hard on the skin it freezes the underlying structures. As thawing takes place, redness and turgescence of the part is noticed and a blister forms in 24–48 hours. Healing goes on under a crust, and the resulting cicatrix is smooth, white and pliable. The application usually lasts from 5 to 30 seconds according to the depth and situation of the lesion. The application is repeated after an interval of 10 to 14 days. The operator's fingers can be protected by a doubled piece of lint rolled round the end of the pencil. In all, 300 cases of oriental sore have been treated in this way. The simple ulcerating cases reacted best, but the sores which were raised above the surface, or were covered with foul granulations, it was found best to scrape well first with a Volkman's spoon under anaesthetic and then immediately to apply the CO_2 pencil. The results have been excellent.

The majority of the cases of oriental sore were diagnosed clinically and not by the finding of leishmania, but all cases had developed while stationed at Fort Lahore, or shortly after returning to cantonments, so there is little doubt of the diagnosis.

C. M. W.

LAVERAN (A.). i. **Infections Expérimentales de Souris, d'un Meriones, d'un Rat et d'un Macaque par la** *Leishmania tropica*.—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8–9. pp. 663–670. With 2 text figs.

ii. **Présentation d'un Chien inoculé avec Succès au Moyen de la** *Leishmania tropica* **sur Souris**.—*Bull. Soc. Path. Exot.* 1914. Dec. Vol. 7. No. 10. pp. 697–698.

i. In this paper the author reviews his experiments with *Leishmania tropica* and mice [see this *Bulletin*, Vol. 4, p. 401]. Of twelve mice inoculated intraperitoneally with cultures of *L. tropica*, eight were males and six of these became infected. An account of four of these is given. There was in each case, after about four months, great enlargement of the testicle which contained large numbers of parasites. The liver, spleen and bone marrow contained none. Only one of the four females became infected and this one developed a tumour at the posterior part of the abdominal wall, containing leishmania in enormous numbers. The tumour eventually retracted, leaving a scar which, on the death of the animal six months after its first inoculation, was found still to contain numerous leishmania. Parasites were also present in the spleen, liver and marrow, so that it would appear that the general infection with *Leishmania tropica* had caused the mouse's death.

A young rat was inoculated in the right testicle with material from the testicle of an infected mouse. Fifteen days later the rat was dead and, though not enlarged, the right testicle contained leishmania in very large numbers. The left testicle and other organs of the body were not infected. Three rats were inoculated in the testicle with cultures of *L. tropica*, but only one of these acquired a local infection,

as was the case with the rat just mentioned. With material from the testicle of an infected mouse, a monkey (*Macacus cynomolgus*) was inoculated intra- and sub-cutaneously on the forehead and thigh in six places. Nodules appeared after the short period of nine days on the thigh, and later on the forehead; there was increase in size to that of an almond. Parasites were present in large numbers. At the time of writing the lesions were still in course of evolution.

ii. In the second paper the author mentions the inoculation of a dog intracutaneously with leishmania from one of the infected mice, as described above. The dog developed a sore at the base of one of the ears. It closely resembled the oriental sore of man.

C. M. W.

SERGENT (Edm.). **Infections Expérimentales de la Souris par des Cultures de la *Leishmania tropica*.**—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 22–25.

Attempts were made to infect six mice by intraperitoneal or intravenous injections of cultures of *Leishmania tropica* isolated from a case of oriental sore in Biskra in October, 1913. After an interval of four months the mice appeared in good health. They were killed and five were found infected, three having parasites in the liver and spleen and two in the spleen only. There were no other lesions, nor were parasites found in any other situation.

The author notes that these results differ from those of LAVERAN and GONDER, who have produced testicular and cutaneous lesions in mice by intraperitoneal injection of cultures of *L. tropica*. The differences may be due to variations in virulence and age of the cultures, or other as yet indeterminate factors. It is possible that injections of *L. tropica* produce first a generalised infection which subsides, the parasites then infecting either the skin (GONDER) or the testicle (LAVERAN).

C. M. W.

NICOLLE (Charles) & CHATTON (Edouard).—**Longue Conservation de la Virulence pour l'Homme de la *Leishmania tropica*, en Cultures.**—*Bull. Soc. Path. Exot.* 1914. Dec. Vol. 7. No. 10. pp. 700–702.

The paper records the successful production of an oriental sore on the forearm of a human being by the injection of a culture of *Leishmania tropica* which had been maintained during the four and a half years since its isolation in 115 sub-cultures on N.N.N. medium. There was an incubation period of one and a half months and the sore which developed was a typical oriental sore which is running the usual course. The observation demonstrates that the virulence of *Leishmania tropica* is not lost by long culture in N.N.N. medium.

C. M. W.

Escomel (Edmundo). **Leishmania Flagelada en el Peru.**—*Cronica Med.* [*Lima*]. 1914. July. 15. Vol. 31. No. 613. pp. 224–227.

This paper has to do with the priority of an observation made by the author some years ago on the presence of flagellate forms of leishmania in scrapings from a case of South American dermal leishmaniasis. His first communication was made on September 6th, 1911, to the Medical Society of Arequipa, and a microscopic preparation showing the flagellate forms was exhibited. In April, 1912, he corresponded with Laveran upon this subject. In December, 1912, La Cava published a paper (this *Bulletin*, Vol. 1, p. 370) giving an account of similar observations made by him in Italy. On the 12th January, 1913, the author recorded before the same Society a second case on which he had made this observation, this time in a case of espundia on the living subject, and not post mortem as in his earlier observation. This finally disproves the view which suggested that the leishmania had become flagellate after death.

C. M. W.

Neligan (A. R.). **A Case of *Leishmania tropica* with a Fatal Termination.**—*Jl. Trop. Med. & Hyg.* 1914. Nov. 2. Vol. 17. No. 21. pp. 322–323.

The case recorded is one of a child in Tehran, Persia, which contracted tetanus from which it died, the only possible point of entry of the organism into the body being an oriental sore.

C. M. W.

PROTOZOOLOGY.

PORTER (Annie). **The Morphology and Biology of *Herpetomonas patellae*, n. sp., parasitic in the Limpet, *Patella vulgata*, together with Remarks on the Pathogenic Significance of Certain Flagellates found in Invertebrates.**—*Parasitology.* 1914. Oct. Vol. 7. No. 3. pp. 322–329. With 17 text figs.

This paper deals with a new species of herpetomonas, *H. patellae*, parasitic in the edible limpet and with the significance of certain flagellates occurring naturally in invertebrates. It is the first time that herpetomonads have been recorded from the Mollusca, and also the first notification of their occurrence in digestive glands, the digestive gland or "liver" of the limpet being infected as well as the gut.

H. patellae is very small, the body of the flagellate form being only 5μ to 7μ long. The non-flagellate forms are relatively large, being 2μ to 3μ long and from 1μ to 1·5μ broad. Multiplication by longitudinal binary fission occurs in the preflagellate and flagellate stages. The mode of transmission is contaminative, post-flagellates being voided with the faeces of the host. The nutrition of the herpetomonad is by absorption of fluid food from its surroundings.

A summary of the experimental results of LAVERAN and FRANCHINI'S work with *Herpetomonas ctenocephali* Fantham, *H. pattoni* Swingle, and *Crithidia fasciculata* Léger, in relation to dogs, rats and mice, is given. By inoculation or feeding of these parasites to the vertebrates, infections with elements chiefly of a leishmaniform nature were produced. Attention is drawn, in this connection, to four points:—(*a*) Species of Leishmania in culture grow into herpetomonad flagellates. (*b*) A herpetomonad parasite, *Haemocystozoon brasiliense* Franchini, has been described from the human subject. (*c*) It can be inferred from the experiments cited that Leishmania and the trypanosomes probably arose from the flagellates of invertebrates. (*d*) Leishmaniform elements or latent bodies, occurring in the internal organs, have been described as part of the life-cycle of trypanosomes in vertebrate hosts. The author considers that "it is possible that the canine kala-azar occurring in the Mediterranean region is really a canine herpetomoniasis due to *Herpetomonas ctenocephali*."

As *H. patellae* occurs in an edible invertebrate, possibly such flagellates are not without pathogenic properties, if they should find their way alive in sufficient numbers into a vertebrate.

H. B. F.

FANTHAM (H. B.) & PORTER (Annie). **Some Insect Flagellates introduced into Vertebrates.**—*Proc. Cambridge Philosoph. Soc.* 1915. Jan. 6. Vol. 18. Pt. 2. pp. 39–50. With 1 plate.

The authors recall that "LAVERAN and FRANCHINI have shown that an experimental leishmaniasis (herpetomoniasis) can be induced in mice and rats by inoculating or feeding them with *Herpetomonas pattoni* Swingle, parasitic in the gut of rat fleas, and in dogs by inoculating them with *H. ctenocephali* Fantham, parasitic in dog fleas, among others." (See this *Bulletin*, Vol. 2, p. 463; Vol. 3, pp. 122

and 515; Vol. 4, p. 381). They therefore undertook a series of experiments, but instead of using nearly associated insects and vertebrates they made "a wide divergence in order to ascertain whether an insect flagellate introduced into a quite unassociated vertebrate might become pathogenic." *Herpetomonas jaculum* Leger, parasitic in the water scorpion *Nepa cinerea*, was chosen as the flagellate, while very young mice served as vertebrate hosts. They also succeeded in infecting a puppy by feeding it on parasitised dog fleas.

The life cycle of *H. jaculum* in *Nepa cinerea* is described*. The flagellate lives in the alimentary tract; it possesses a non-flagellate stage in its life cycle, an ovoid Leishmania-like resistant body that is passed from the host with the faeces, and is capable of infecting other Nepa. The anterior part of the gut, consisting of the oesophagus and stomach, contains mostly pre-flagellate and young flagellate forms; the posterior gut, consisting of the intestine, contains flagellates in various stages of division and the resistant, post-flagellate forms—a fact not without significance in the experiments.

There were seven experiments, each with a control; some were performed in Liverpool with mice and Nepa obtained locally, others in Cambridge, the Nepa being collected in the neighbourhood.

"In most cases an interval of a few hours was sufficient to allow of the appearance of rounded, non-flagellate forms of *H. jaculum* in the peripheral blood. The mice became weaker and either died or were killed *in extremis*. Examination of their organs showed the presence of non-flagellate (leishmaniform) and of flagellate forms in the liver, spleen, bone-marrow and blood, occasionally in other organs. The liver was always the seat of heaviest infection. The parasites kept the facies of *H. jaculum* and were pathogenic to the mice. The number of flagellate forms present and their fine development was noteworthy, and is unlike what has been obtained before in the experiments by LAVERAN and FRANCHINI with other insect flagellates in mice."

Protocols follow. Four of the mice were fed, three were inoculated intraperitoneally; six young mice died, or were killed when they were very ill, and one, an adult weighing 17 gms., recovered. Two months later it was well and had gained weight. Parasites were seen in its blood on the fourth day after inoculation, but not later.

In the puppy experiment the animal was fed during a period of 36 days with a total of 190 dog fleas, *Ctenocephalus canis*, at nine feedings. Some of the fleas were infected with *H. ctenocephali*. Ten days after the last feed the puppy became ill with fever but rapidly recovered. "Examinations of the blood made 21 days after the first and 12 hours after the sixth feed of fleas showed a very few leishmaniform elements both free in the blood strean and, in one case, within a mononuclear cell." The puppy was still under observation. The authors point out in connection with these experiments that *Leishmania* develops into a flagellate herpetomonad stage in the culture tube and in the gut of certain insects.

An account follows of the morphology of *Herpetomonas jaculum* in the mouse, illustrated by a plate of 20 figures. Shortly after their introduction, the flagellate forms become rounded, the flagella disappear and the parasites are found in the blood, usually as free leishmaniform bodies. Similar forms occur in the internal organs

* See PORTER, *Parasitology*, Vol. 2, p. 367.

where later a development occurs to typical herpetomonads. Multiplication takes place in the mouse much as it does in the Nepa. Rounded leishmaniform parasites have been found within leucocytes, but never numerously. The dimensions of flagellate and non-flagellate forms agree with those of *Herpetomonas jaculum* in the insect.

A discussion follows on the forms of *Herpetomonas jaculum* most infective to mice. It is concluded from the experiments that "the post-flagellate stages have greater powers [than pre-flagellates or immature flagellates] of growing and multiplying successfully in the vertebrate host." Thus there seems evidence to show that "the form of insect flagellate best adapted for transference from insect to insect is also the form most effective in producing disease." The authors compare the induced herpetomoniasis of the mouse with leishmaniasis. It is noted that "the non-flagellate forms of *H. jaculum* in mice have their blepharoplasts in almost any position other than that characteristic of the Leishman-Donovan body." In this herpetomoniasis of mice well-formed flagellates are found in the liver and elsewhere, which is not the case in kala azar. "That the two diseases are allied is undoubted." The conclusions are as follows:—

"1. Insect flagellates, e.g., *Herpetomonas jaculum* (Léger) from *Nepa cinerea*, and *Herpetomonas ctenocephali* (Fantham), parasitic in the dog-flea, *Ctenocephalus canis*, can live inside certain vertebrates (e.g. mouse and dog respectively) and can multiply therein. This we have shown experimentally.

"2. If such flagellates be inoculated intraperitoneally or are fed by the mouth in food, the flagellates can find their way into the blood stream and internal organs (e.g. liver, spleen, bone-marrow) of the vertebrate host.

"3. The insect flagellates are pathogenic to the vertebrates experimented upon, producing symptoms like those of leishmaniasis (Kala-azar).

"4. The oval post-flagellate forms appear to be more capable of developing in vertebrate hosts than are other stages of the herpetomonad parasite of the insect.

"5. It may be expected that the various leishmaniases occurring in different parts of the world will prove to be insect-borne herpetomoniases."

A. G. B.

MACKIE (F. Percival). **A Flagellate Infection of Sand-Flies.**—*Indian Jl. Med. Research.* 1914. July. Vol. 2. No. 1. pp. 377–379. With 1 plate.

A number of *Phlebotomus minutus* was examined and found to contain Herpetomonas flagellates [in the gut ?]. Seven out of 65 female flies were infected. The parasites "were only found when the remains of a blood meal were present in the fly; neither the unfed females nor the males were ever found to be infected." Flagellate and round forms of the parasite were observed and are represented by 11 figures on a plate.

The author's conclusions are as follows:—

"Ten per cent. of female sand-flies, *Phlebotomus minutus*, were found to be infected with a flagellate of the genus *Herpetomonas*.

"It is probably a natural parasite of the fly, and is not likely to have any relation to the occasional habit of *Phlebotomus* as a human blood sucker.

"The natural host of *Phlebotomus minutus*, as HOWLETT has shown, is probably the common wall lizard.

"As I cannot find that the flagellate has been previously described, I suggest for it the name *Herpetomonas phlebotomi* (nov. spec.)."

In an addendum the author states that the result of the injection of the herpetomonad into the body cavity of a wall lizard was negative.

[It should be noted that WENYON in 1912 recorded the presence of a Herpetomonas in the gut of Phlebotomus in Aleppo.]

H. B. F.

WOODCOCK (H. M.) & LAPAGE (G.). **Observations on the Life-Cycle of a New Flagellate, *Helkesimastix faecicola*, n. g., n. sp.: Together with Remarks on the Question of Syngamy in the Trypanosomes.**—*Proc. Roy. Soc.* 1915. Feb. 1. Vol. B. 88. No. B. 604. pp. 353–370. With 2 plates.

The organism, *Helkesimastix faecicola*, n.g., n.sp., was found in goat dung and sometimes in sheep dung. It is considered to be a "passenger," passing through the gut of the host passively in an encysted condition. The authors studied it in culture, using principally Lemco-agar. The permanent cysts are spherical or slightly ovoid, 3 to 3·5μ in diameter. Excystation takes about twenty-two hours in fresh media, and only occurs when there is a plentiful development of active, aërobic bacilli. The body of the flagellate is elongate and fairly cylindrical, the anterior end being bluntly rounded and the posterior end tapering. The body is usually about 6 to 7μ long and 2 to 2·5μ broad. There is a single long flagellum arising at the anterior end and directed backwards. In life the flagellum is usually contiguous to the body for almost the entire length of the latter, and lies along the middle of the upper (dorsal) side of the organism, but no attaching membrane is developed. It is a trailing flagellum. The nucleus is spherical and near the anterior end, and contains a karyosome. There is a small contractile vacuole, generally situated towards the posterior part of the body. The principal mode of nutrition is by osmosis. The more usual type of division is by transverse fission, but occasionally it may be more in a longitudinal plane. Conjugation occurs in the life-cycle, and the resulting zygote becomes surrounded by a "shrinkage" cyst. After a certain number of subcultures have been made the flagellates no longer undergo syngamy, followed by cyst formation. The "intensive" culture of the flagellate has resulted in the loss of power to undergo true syngamy and to form cysts. The further existence of the strain is then dependent on continued transference to fresh "constant" medium.

The authors consider the bearing of this phenomenon on the life-cycle of trypanosomes in vertebrates, in which conjugation or syngamy is absent. They consider that "the loss of syngamy is due to the surfeit of nutrition," as the trypanosomes live in a rich nutritive medium, namely blood.

The paper is illustrated by 69 figures. H. B. F.

CHATTERJEE (Gopal Chandra). **A Culturable Free Living Flagellate and the Determination of the Lethal Value of Certain Chemicals thereon.**—*Indian Jl. Med. Research*, 1914. Oct. Vol. 2. No. 2. pp. 594–603. With 1 coloured plate.

The organism was found while making a routine examination of a sample of water collected from a tank [in Calcutta ?]. The flagellate grew in ordinary bouillon and peptone water, and could be transplanted

from day to day to fresh media. It is stated to possess "two flagella, a rudimentary undulating membrane, one nucleus, one blepharoplast and basal granules." It shows marked pleomorphism when cultivated in different media. In normal saline solution it multiplies and is more active than in bouillon, "but it becomes much shrunken and no undulating membrane can be made out." A fully developed form measures 16μ to 20μ in length and 4μ in breadth; "the upper flagellum is 5μ, the lower flagellum 10μ." Anteriorly there is a depression forming a cytostome and cytopharynx. Some of the flagellates, as seen in tap-water, are spherical, measuring 7μ in diameter. Some are very small, being only 3μ to 5μ in diameter. The organism is stated to multiply more vigorously at blood heat than at 18° to 20°C.

The author adopted the procedure for the Rideal Walker test for determining bactericidal value of chemicals. The substances tested included cyllin, lysol, potassium permanganate, quinine hydrochlorate dissolved in dilute hydrochloric acid, quinine bihydrochlorate dissolved in distilled water, carbolic acid, and hydrochloric acid.

Lastly, the author attempts to determine the systematic position of the flagellate and places it in the "sub-family" Trypanoplasma. He states that it is "quite possibly a new species." [Apparently he considers that a rudimentary undulating membrane is present. This organella, however, is not described in the paper, and certainly does not appear to be present from an examination of the figures on the plate accompanying the paper. The figures certainly suggest that the flagellate belongs to the genus Prowazekia, members of which are known to occur in cultures from human faeces, human urine, and the slime on stones at the biological station of Lunz. It is to be regretted that the study of the organism was not made in collaboration with a protozoologist. The author should have read the paper by SINTON on *Prowazekia urinaria* (see this *Bulletin*, Vol. 1, p. 158), wherein a good general account of such organisms is given].

H. B. F.

SEIDELIN (Harald). **Klossiella sp. in the Kidney of a Guinea-pig.**—*Ann Trop. Med. & Parasit.* 1914. Dec. 15. Vol. 8. No. 3. pp. 553–564. With 2 plates.

A parasite of the renal epithelia of mice in Massachusetts was described in 1889 and further studied in 1902, being named *Klossiella muris* by SMITH and JOHNSON. It belongs to the Coccidia. The parasite of guinea-pigs is very like it.

The organism was found by the author in the kidneys of two guinea-pigs which had been purchased locally and used for yellow fever research at Yaba near Lagos, Nigeria. "The cells mostly affected are the epithelia of the convoluted tubules of the first order, but also those of the second order and the straight tubules in the loops of Henle are sometimes the seat of the parasites." In addition, the kidneys showed marked necrobiotic changes of the epithelia, especially in the convoluted tubules. Many tubules and some Bowman's capsules contained granular exudates, and there were some irregular patches of hyperaemia. The various forms of the parasite occur in the epithelial cells. There appears to be a double division, first into sixteen to twenty, then into thirty daughter forms.

The first division is described as schizogony, whilst it is undecided whether the second division is schizogonic or sporogonic.

In conclusion the author compares his parasite with *Klossiella muris*. The number of daughter forms appears to differ. The name *Klossiella cobayae* is proposed for the parasite of guinea-pigs.

The various stages are illustrated in the two plates, one of which consists of microphotographs.

H. B. F.

Acton (Hugh W.) & Knowles (R.). **Studies on the Halteridium Parasite of the Pigeon, *Haemoproteus columbae*, Celli and San Felice.**—*Indian Jl. Med. Research.* 1914, Apr. Vol. 1. No. 4. pp. 663–690. With 5 coloured plates.

This long, interesting and well illustrated paper is divided into three parts. In the first portion the life-cycle of *Haemoproteus* (*Halteridium*) *columbae* in the vertebrate host, a pigeon, is described. The second part is devoted to a study of the gametes. The last section records the results of the cultivation of the Halteridium parasite of the pigeon in vitro by Bass's method. A fourth part, dealing with the extra-corporeal cycle of the protozoon in the *Lynchia* fly, is promised later, in collaboration with Mrs. Adie.

The authors state that: "The description [of the Halteridium parasite in the pigeon] given by Beaurepaire-Aragao (1908) is misleading; whilst that given by Negri (1913) is only correct for the mature schizont stage. The figures given in Doflein after Labbé are inaccurate and, in our opinion, represent the life-cycle of the Proteosoma parasite. The details of the asexual cycle of the Halteridium parasite are puzzling; but we believe that the description given below is accurate in its essentials." [The paper by Negri was summarised in this Bulletin, Vol. 2, p. 56.]

In the space available it is quite impossible to give a full summary of the paper. The authors themselves summarise each section at length, and the following extracts are taken from their summaries. [The portions omitted are chiefly repetitions.]

Part I. :—

"(1) The asexual cycle is, for a very short time, confined to the erythrocytes. The young trophozoites then escape from the erythrocytes and have an extra-cellular cycle of development in the lung capillaries.

"(2) Gametes are resistant and long-lived forms, produced from merozoites.

"(3) Merozoites infecting red blood cells give rise to either schizonts or to gametes. This depends upon the favourable or unfavourable environment present in the tissues of the host. In the lung capillaries, where conditions are favourable, schizonts are produced; in the peripheral blood, where, perhaps, conditions are less favourable, gametes are formed.

"(7) The development of the asexual cycle in the lung causes inflammation and hypertrophy of the lining of the alveoli, and is probably a predisposing cause of pneumonia."

Part II. :—

"(1) Gametes diminish in number in those infected pigeons which are supplied with abundance of food and kept under good hygienic conditions. The practical importance of this observation is that the infected feeding grounds for the fly are diminished both in area and in intensity for the next season's epidemic.

"(2) The gametes have a very prolonged life. If an infected pigeon be killed and the lungs examined, it is found that the asexual cycle in the lungs is only present in those pigeons which show young gametes in their peripheral circulation. Where young gametes have been absent for some days from the peripheral circulation the asexual cycle is absent from the lungs. This is further confirmed by our venesection experiment. Mechanical removal of parasites by this method causes a permanent decrease in the number of parasites in those pigeons in whom the asexual cycle is absent. On the other hand, where the asexual cycle is still persisting the temporary reduction which occurs is followed in 10 to 15 days' time, by a further output of new gametes.

"(5) The determination of sex in the gametes is probably according to the Mendelian law; the female being the dominant and the male the recessive character.

"(6) The destruction of gametes occurs in the spleen by the agency of the mononuclear leucocytes; and it is particularly the young gametes which are phagocytosed.

"(7) Gametes, being resistant forms, with a prolonged life-history, are the means by which the parasitic race is preserved from annihilation during the winter months which elapse between one fly season and another."

Part III. :—

"(1) Female gametes can be kept alive for 64 hours when grown *in vitro* by Bass's method.

"(2) Male gametes readily die off when separated from the body of their host.

"(3) Trophozoites are found in cultures made from the peripheral blood which contains mature gametes only.

"(4) Fragmentation of the chromatin of the female gametes is observed in such cultures, followed by budding which sets free merozoites.

"(5) The appearance of trophozoites in cultures from blood which contains only gamete forms (and of these gametes the males die off readily, whilst the females bud to form merozoites), shows that the trophozoites were derived from the female gametes.

"(6) This phenomenon may occur in the body of the host and be caused by external stimuli, e.g., changes in temperature, influence of toxins, etc., which, if their influence be not too strong or too prolonged, allow the gametes to partially recover and to bud before dying.

"(7) As the normal habitat of the schizont is a lung capillary, the trophozoites when implanted into erythrocytes do not mature into adult schizonts.

"(8) The evidence submitted is strongly in favour of the formation of trophozoites from gametes under certain circumstances and explains for these parasites the causation of a relapse, i.e., a return from sporogony to schizogony by a biological process comparable to the parthenogenetic phenomenon seen in metazoa."

[The author often referred to as C. F. Cragg in the paper is the well-known American investigator, C. F. Craig.]

H. B. F.

Thomson (J. G.) & Fantham (H. B.). **The Culture of *Babesia* (*Piroplasma*) *canis* in vitro.**—*Ann. Trop. Med. & Parasit.* 1913. Dec. 30. Vol. 7. No. 4. pp. 621–632. With 1 plate and 5 text figs.

The Successful Cultivation of *Babesia* (*Piroplasma*) *canis* vitro, following the Method of Bass.—*Trans. Soc. Trop. Med. & Hyg.* 1914. Jan. Vol. 7. No. 3. pp. 119–125. With 1 plate.

In these two papers, which are based on the same experiments, the authors state that cultivation of *Babesia canis* succeeded in two out

of four attempts. The animals used were puppies about three months old. The technique employed was that of C. C. Bass in its simplest form, and was as follows :—

"Ten cc. of heart blood, drawn with aseptic precautions, was mixed with 1/10 cc. of a 50 per cent. aqueous solution of Merck's glucose. The blood was carefully and gently defibrinated by means of a rod, and the clot was removed. It was noticed that the amount of clot removed was much in excess of that taken from a similar quantity of human malarial blood. The defibrinated blood was distributed into smaller tubes, placing about 1 inch of liquid in each tube. No centrifugalisation was necessary. The tubes were incubated at 37° C. The corpuscles settled to the bottom in a short time, leaving a layer of serum above.

"Marked haemolysis was seen in all the cultures attempted. It was found advantageous to take the blood of the puppy before the crisis, that is, before too many parasites were present in the peripheral or heart blood.

"No sodium citrate nor ascitic fluid was added to the cultures, as was done by Ziemann (1913), nor citrate and saline as used by Toyoda (1913)."

In the first culture, which was observed for 68 hours altogether, three divisions of the piroplasms occurred, the third division being completed in 48 hours. The second culture progressed more slowly, and two divisions were followed in 41 hours, the culture being observed for 66 hours altogether. The morphology of the various cultural forms is described at length and shown in text figures. All the phases of division by the mode of gemmation with chromatinic forking, characteristic of the genus *Babesia*, were followed. There was insufficient material for sub-cultures, though an animal was successfully inoculated with cultivated parasites.

The authors' summary is as follows :—

"1. We have succeeded in cultivating *Babesia* (*Piroplasma*) *canis* in two out of four attempts, following the method of Bass, using blood and glucose, and incubating at 37° C.

"2. In one of these cultures, starting with heart blood containing corpuscles infected with one, two or, exceptionally, four piroplasmata, we succeeded in obtaining a maximum of 32 merozoites in a corpuscle.

"3. Various types of Babesia were seen in these cultures, namely, pyriform, amoeboid, rounded and oval parasites. Division of rounded forms was observed, following the method of gemmation with chromatinic forking. There was evidence, in stained specimens, of direct binary fission.

"4. Haemolysis occurred in all the culture tubes.

"5. A puppy was successfully inoculated from a 41-hours' culture and succumbed to piroplasmosis on the fifth day.

"6. *Babesia canis* is not so easily cultivated by Bass's method as the malarial parasites of man."

The plate contains nine microphotographs of cultural parasites.

W. Yorke.

i. Chalmers (A. J.) & Archibald (R. G.). **Babesia or Piroplasma.**—*Jl. Trop. Med. & Hyg.* 1914. Nov. 2. Vol. 17. No. 21. p. 323.

ii. Leiper (R. T.). **Babesia or Piroplasma: A Reply to Chalmers and Archibald.**—*Ibid.* 1915. Jan. 1. Vol. 18. No. 1. p. 7.

i. The authors find that the name *Piroplasma* should be used for the well-known genus of Protozoa to which the organisms causing redwater fever in cattle and malignant jaundice in dogs belong. While searching

botanical literature they found that the name *Babesia* had been used by TREVISAN in 1889 for ellipsoidal cocci found in persons suffering from yellow fever and from erysipelas. The name *Babesia* was not applied to the protozoal organisms till 1893 by STARCOVICI. A list of synonyms is given. The generic name *Piroplasma* was given by W. H. PATTON in 1895.

ii. In reply to the proposal of CHALMERS and ARCHIBALD the author writes: "It appears to have escaped the authors' recollection that the first of the International Rules of Zoological Nomenclature stipulates that: '(1) Zoological Nomenclature is independent of Botanical.'"

Hence the generic name *Babesia* stands. H. B. F.

SANGIORGI (Giuseppe). **Reperto di "Corpi anaplasmasimili" nel Sangue dell' Uomo e degli Animali. (A Proposito della Natura dei Cosidetti "Anaplasmi.")** [Discovery of Anaplasma-like Bodies in the Blood of Man and Animals.]—*Pathologica.* 1915. Jan. 15. Vol. 7. No. 149. pp. 27–29.

This paper consists of an account of the various sources from which "Anaplasma," "marginal points" and "coccus-like bodies" have been recorded, together with a note on the occurrence of Anaplasma-like bodies found by the author in the splenic blood of a Catanian child infected with kala azar. He then discusses the different views held by various workers on Anaplasma as to whether these bodies are stages in the evolution of a piroplasm such as *Nuttallia equi*, the possibility of their connection with Toxoplasma and also the possibility that these Anaplasma-like bodies, marginal points or coccus-like bodies are cell inclusions or the products of nuclear decomposition of normoblasts. He inclines finally to the latter hypothesis.

H. B. F.

LAVERAN (A.). **Nouvelle Contribution à l'Etude du *Toxoplasma gondii*.** —*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 58–63. With 18 text figs.

The animals found sensitive to inoculation with *Toxoplasma gondii* were mice, field-mice (*Mus sylvaticus*), rabbits (chiefly by intravenous inoculation), guinea-pigs, moles, hedgehogs, dogs and padda birds. On the other hand, pigeons were only slightly sensitive, and rats, certain dormice, shrews, fowls, frogs and lizards were refractory.

In the present paper the author records his observations in detail on inoculation—usually intraperitoneally—of *T. gondii* from white mice into two dwarf mice (*Mus minutus*), three field mice (*Mus sylvaticus*), a Tunisian jerboa (*Jaculus orientalis*), two dormice (*Myoxus glis*) and two *Myoxus nitela*. All became infected except one of the *Myoxus nitela*, the other being only slightly infected. A shrew (*Sorex vulgaris*) did not become infected. A strain slightly virulent to the pigeon in 1913 has now, after numerous passages through mice, lost its virulence for the pigeon.

Regarding the morphology of the parasite the author considers that the organism divides only by binary fission and never by multiple

fission. The nuclei of the host cells may not be easily stained, but yet are retained. The author could not find either a blepharoplast or a flagellum in any of the parasites.

Fatty degeneration of the liver occurs in the infected hosts.

Attempts at culture were unsuccessful.

H. B. F.

Fantham (H. B.) & Porter (Annie). **The Morphology, Biology and Economic Importance of *Nosema bombi*, n. sp., parasitic in Various Humble Bees (*Bombus* spp.)**—*Ann. Trop. Med. & Parasit.* 1914. Dec. 15. Vol. 8. No. 3. pp. 623–638. With 1 plate.

The paper contains an account, with illustrations, of a new species of Nosema pathogenic to humble bees, which are essential for the pollination or fertilisation of the red clover in England.

The first four paragraphs of the author's summary are as follows :—

" 1. *Nosema bombi*, n. sp., is parasitic in the alimentary canal and Malpighian tubules of various species of humble (or bumble) bees, *Bombus agrorum*, *B. hortorum*, *B. latreillelus*, *B. lapidarius*, *B. sylvarum* and *B. terrestris* being affected. It may also pass naturally to the hive bee, *Apis mellifica*, and to *Apis florea*. It is pathogenic to all the above hosts.

" 2. The morphology of *N. bombi* resembles that of *N. apis* in its general outlines. The planonts are about $2{\cdot}2\mu$ in diameter. Meronts vary in size and in shape with the space in which they were formed. They are most abundant in the Malpighian tubules. The spores are oval, and average $5{\cdot}2\mu$ long by $3{\cdot}7\mu$ broad.

" 3. The mode of infection is contaminative, by means of infected food and drink. Larvae can become infected from the food soiled by the parental excrement, in which they hatch out.

" 4. *Nosema bombi* can pass from one species of humble bee to another without change of morphology or virulence. When it reaches hive bees its facies is preserved, but its pathogenic action is accelerated."

The remaining two paragraphs deal with economic importance and preventive measures.

A. G. B.

Chatton (Edouard) & Blanc (Georges). **Existence de Corps Leishmaniformes dans les hématoblastes d'un Gecko Barbaresque, *Tarentola mauritanica* L. Gunth.**—*C. R. Soc. Biol.* 1914. July 31. Vol. 77. No. 27. pp. 430–433. With 1 text fig.

The authors, while working on the Commission of the Pasteur Institutes of Paris and of Tunis for the study of oriental sore, have examined certain geckos in an endeavour to ascertain whether there is a natural reservoir of the virus for the endemic leishmaniasis in the region of Gafsa. The geckos were examined on account of their promiscuous association with man, their presence in places where Phlebotomus swarmed and their insectivorous diet, which gave them the chance of becoming naturally infected with the intestinal flagellates of insects (cf. experiments of Laveran and Franchini).

One gecko out of eight examined at Metlaoui contained a new parasite occurring only in its haematoblasts. The parasites took the form of small groups of elements in a vacuole, which occupied one of the poles of the corpuscle, whose nucleus was displaced towards the opposite pole. These elements were fusiform or with some resemblance to toxoplasms. A median nucleus and a blepharoplast

were present, the latter being orientated as in Leishmania. The number in a group varies from 5 to 10, and the number of parasitised haematoblasts is not great. Attempts at cultures and of infection of the geckos, *Tarentola mauritanica*, with oriental sore are to be undertaken.

The Tarentola also contained a haemogregarine which the authors consider different from that described by Billet in 1901 from the same lizard. It is larger, and enclosed in a cuticle formed by the periplast of the host cell. Binucleate and trinucleate forms have been seen, so that intraglobular schizogony with few merozoites occurs.

Trypanosoma platydactyli was present much more rarely in the geckos.

The small, new parasites are considered to be unconnected with the haemogregarine and trypanosome. All three forms are shown in the text figure.

H. B. F.

Chatton (Edouard) & Blanc (Georges). **Sur un Hématozoaire Nouveau, *Pirhemocyton tarentolae*, du Gecko, *Tarentola mauritanica*, et sur les Altérations Globulaires qu'il détermine.**—*C. R. Soc. Biol.* 1914. Oct. 30. Vol. 77. No. 28. pp. 496–498.

This paper refers to the previous account given by the authors in July, 1914, and extends their observations to a new parasite. The parasite, named *Pirhemocyton tarentolae*, n.g., n. sp., was found in one gecko out of three from Matmata in May, 1914, and again in two out of about 40 from the district of Metlaoui, in July, 1914.

The presence of the parasite can be diagnosed in fresh blood by the appearance in the red cells of colourless, refringent spherical globules, usually one in each red cell, lying between the edge and the nucleus of the cell. These bodies represent a cytoplasmic alteration and a product elaborated by it under the influence of the parasite.

The parasites are only easily visible in stained preparations. Each is usually solitary and within the globular cytoplasm. At first it is a nucleated spherule, 1μ in diameter. By growth it becomes piriform, 3μ to 4μ long by 1·5μ to 2μ broad. The nucleus forms a band-like structure equatorially. The parasite presents analogies with the piroplasms. No evolutionary forms have been seen, and the mode of multiplication is unknown. No parasites have been observed free in the plasma, and no forms found in the organs other than those found in the circulating blood. Cultures on the N.N.N. medium have been negative.

Each parasitised globule contains a refringent inclusion, much larger than the parasite, 7μ to 8μ in diameter, which is homogeneous and cyanophile in stained preparations. They seem to be inert. No transition forms between them and the parasite have been seen.

Though the study of the parasite is still incomplete (the authors being on military service) the name *Pirhemocyton tarentolae* is given to the organism.

H. B. F.

Blier (Jules). **L'Hémoglobinuria Bovine du Chile (Maladie à Parasites Spirochètiformes).**—*C. R. Acad. Sci.* 1914. Dec. 14. Vol. 159. No. 24. pp. 815–817.

The author describes a bovine haemoglobinuria present in the Santiago region of Chili. The malady is seasonal, more frequent in February and March. The principal symptom is blood in the urine, accompanied by fever, exophthalmia, madness, vertigo, generalised icterus, expulsion of blood by the anus, and often bleeding gums. The illness evolves in 48 hours and usually ends in death. Five per cent. of the imported adult cattle are killed annually by it. It is less frequent in the rest of Chili than anthrax, with which it has been confused. This confusion is aggravated by the presence of symptomatic anthrax.

The lesions resemble those of yellow fever, the muscles and serosa being yellow; there is hypertrophy of the gall-bladder, the liver shows yellow degeneration, with haemorrhagic layers as large as a pea, in which the causal parasites are found. The spleen is also hypertrophied, there are profound alterations of the supra-renal capsules, subcutaneous haemorrhages and often a roseola on the diaphragm. To find the lesions, slaughter is necessary, as they disappear after natural death.

The organism found in slaughtered cattle recalls spirochaetes or spirilla, but differs in being more plastic which allows of considerable contraction. The parasite can reach 60μ long by 1μ broad. Shorter forms are inflated at the centre. One extremity is more pointed than the other. By staining with Borrel blue and eosin, deep red granules of a refringent nature are seen. A microphotograph has shown two flagella, one at each end, the flagella being unequal. The parasites recall those figured by the brothers Sergent, belonging to the provisional genus *Sergentella* of Brumpt.

These parasites have been proved to be the excitant of the disease by inoculation experiments. The incubation period is five to six days. The transmission of the disease is only possible at the commencement of the malady, as with yellow fever. A benign infection follows inoculation, but whether it confers immunity is not known, the experiments having been interrupted by the war. The organism has been found only in the lesions and has not been seen alive. A few recoveries have been recorded.

The transmitter of the malady is not known, but many breeders consider the Acarid Tetranychus to be the vector. This mite weaves webs on the herbage, and is ingested with forage. This idea has been contested, but it gives a name to the malady, "tela araña" (spider's web). The persistent rains of the Chilian autumn check the epizootic a little.

H. B. F.

Erdmann (Rhoda). **A New Culture Medium for Protozoa.**—*Proc. Soc. Experim. Biol. & Med.* 1914. Dec. Vol. 12. No. 3. pp. 57–58.

The author states that a satisfactory medium for the culture of trypanosomes on a slide under a cover glass has hitherto not been described. "The method here outlined makes possible the continued study of the life history of the organism either in prepared culture medium or in inoculated tissue." "As a culture medium the plasma

of the host is employed and this is either inoculated with the trypanosomes themselves or used as a medium for the growth in vitro of various infected tissues of the host." Using rat plasma in studying *Trypanosoma brucei* the trypanosomes have been kept "in a normal condition for an indefinite period.'

The method used was as follows :—"The plasma was obtained by the method of HARRISON, BURROWS and WALTON, the latter making adaptations from mammalian plasma." "The blood from the infected rat was taken and put into a small drop of plasma on a cover glass and then this was further diluted with plasma in order to reduce the number of blood corpuscles in the hanging drop which was taken from this. The cover glass with the hanging drop was either placed on a depression slide or on a regular slide for study with dark field illumination." Similarly, "pieces of tissue were placed in plasma under a cover glass and sealed." Aseptic precautions were taken.

By this means many of the stages of trypanosomes described by various authors from the vertebrate and invertebrate hosts have been studied in vitro. The author considers that "this method may be employed not only for blood parasites but for all protozoan forms which are parasites in cells."

H. B. F.

MACFIE (J. W. Scott). **Notes on Some Blood Parasites collected in Nigeria.**—*Ann. Trop. Med. & Parasit.* 1914. Dec. 15. Vol 8. No. 3. pp. 439–468. With 2 coloured plates and 8 text figs.

The paper is divided into six sections :—

(1) Babesiasis of domestic animals in Nigeria.—Symptoms of disease were not marked and haemoglobinuria was never observed. Parasites were found in two Hausa cattle from Calabar, two dwarf cattle from Ikotobo, and 11 sheep from Lagos and Onitsha, forming 25 per cent. of the animals examined. The parasites may have been *Piroplasma mutans*; their morphology was like *Theileria parva*, but no Koch's bodies were seen.

One of the Hausa cattle from Calabar contained a Babesia with an unique morphology, which may have been a new species. One of the dwarf cattle had a double infection of a Theileria-like parasite and *Babesia bigemina*. The author remarks that in any attempts to improve the breed of domestic animals in Nigeria by introducing stock from Europe, it would be necessary to guard not only against tsetse-fly but also against "the tick that transmits babesiasis."

Paraplasma flavigenum and *Paraplasma cobayae*, n. sp., were found in guinea-pigs. The second species (*P. cobayae*) was "morphologically similar to the first, but differing from it especially in producing stippling of the red corpuscles. It was found frequently in the blood of stock guinea-pigs obtained from Calabar and Aro. Nothing is known as to its pathological significance."

(2) A Spirochaete isolated from the blood of a guinea-pig.—The parasite was observed in a culture of heart blood (to which glucose had been added) of a guinea-pig at Lagos. The parasites were 2μ to 9μ long, except two specimens which were 14μ. The ends were usually blunt. The organism differs from that found by De GASPERI (1912) in a culture of heart blood in guinea-pigs.

(3) Bacilliform bodies found in the red corpuscles of a rat. The bodies measured 1μ by 0·25μ. They occurred only in normally stained red cells. The author thinks that "the bodies were the same as those originally described by Graham-Smith, and subsequently named *Grahamella* by Brumpt."

(4) A disease of fowls characterised by inclusions in the leucocytes.—This was observed in five fowls from Eket and Ikotobo during November and December, 1913. The symptoms somewhat resembled those of fowl spirochaetosis, but no spirochaetes were seen. "In every case leucocytes were found enclosing chromatic granules and rings of a type that did not occur in the blood of healthy fowls." "No ticks were found on the fowls, but only a few minute red mites on the skin under the wings."

The disease is inoculable. It was exceedingly acute and death usually occurred within two days. "It is suggested that these cell inclusions were the specific cause of the disease."

(5) Blood parasites of lizards and toads.—The lizard was *Agama colonorum*, and the toad was *Bufo regularis*. Out of 38 lizards 15 were parasitised, and of 28 toads 12 were parasitised. Multiple infections were common.

Among the parasites of lizards were trypanosomes, filarial embryos (slender and stumpy), small dumb-bell shaped bodies associated with the microfilariae, haemogregarines (endoglobular and free), leucocytogregarines and haemocystidia.

In the toads were found trypanosomes (*T. mega*, *T. rotatorium* and another possibly new), filarial embryos without a sheath, and haemogregarines.

(6) The occurrence of a spirochaete in the gut of *Glossina tachinoides*.—Tsetse-flies were dissected at Ikotobo in December, 1913. "In the lower half of the gut of one *G. tachinoides*, a female, innumerable spirochaetes were found. The fly had been fed for some days on a clean guinea-pig, but although the blood of this animal was repeatedly examined, no spirochaetes were ever found in it." Long forms measured 15μ to 35μ, and short ones 7μ to 10μ. The extremities were blunt. The organism seems to be different from *S. glossinae* found by Novy and Knapp (1906) in the stomach of *G. palpalis*.

H. B. F.

Castellani (Aldo). **Note on two Protozoal Organisms.**—*Far East. Assoc. Trop. Med. C. R. Trois. Congrès Biennal. Saigon* (1913). 1914. pp. 113–118. Witb 2 plates.

The first organism described is an "intestinal protozoal parasite producing dysenteric symptoms in man." The parasite was seen in three cases in Ceylon. In each case the dysentery was mild. The organisms were examined in fresh and stained preparations. They were elongate motile bodies. No flagella or cilia were seen. No distinct nucleus was observed, though in some stained preparations "a large mass of chromatoid, roundish granules are seen." Nothing is known of their reproduction, and attempts at cultivation failed. The zoological position of the organisms is uncertain. Dr. S. C. Paul has named them *Castellania castellanii*. The author thinks that the parasite "probably represents a new genus and species."

[Apparently the organisms described are the same as those discussed at a meeting of the Society of Tropical Medicine and Hygiene held in London on May 15th, 1914. On that occasion, Dr. G. C. Low exhibited, on behalf of Dr. Castellani, a stained specimen of an organism which Dr. Castellani had termed an Entoplasma. See *Transactions of the Society of Tropical Medicine & Hygiene*, Vol. 7, pp. 216–218, with 1 plate.]

The second parasite is described as "Protozoa-like bodies in a case of protracted fever with splenomegaly." It is now known as *Toxoplasma pyrogenes*, having been found in a Sinhalese boy. See this *Bulletin*, Vol. 3, pp. 521–522, with illustrative figures.

H. B. F.

SLEEPING SICKNESS.

NYASALAND PROTECTORATE. **Sleeping Sickness Diary.** [HEARSEY (H.), Principal Medical Officer.] 1914. Dec. 31. Part 24. 8 pp. Zomba: Government Printer.

This Diary is dated December 31st, 1914. Between the end of the previous May and this date 19 cases of sleeping sickness have been notified, bringing the number of recorded cases to 211. Eight were found in the sleeping sickness area of the Dowa District, nine in the Marimba District, which adjoins it on the north, and two in districts to the south. An account of these cases is given. One was the father of two previous cases (males). The dates on which trypanosomes were found were April 17th and July 7th; for the third (? intermediate) case no date is given. All these lived in the same hut. The numbers diagnosed might have been greater, but owing to the outbreak of war investigations were suspended in three of the districts at the end of July and in the remaining district early in October. It is stated that in the Proclaimed Area of the Dowa District there is now a cleared area of varying extent round every village in the fly area; "in most the result has been excellent." Clearings were also made along one of the main roads and on some lesser roads.

A. G. B.

NORTHERN RHODESIA. [**Tours in Sleeping Sickness Areas in Northern Rhodesia.** Drs. G. W. ELLACOMBE, H. LEACH.] MS. Received by the British South Africa Company, January 27th. 1915.

Dr. Ellacombe visited Ndola, on the Rhodesia-Katanga Junction Railway near the Congo border, in September, 1914, to enquire into deaths which had been reported; it was in this neighbourhood that a European was infected with trypanosomiasis two years previously. He palpated 1805 natives and detected three cases, trypanosomes being found in one instance in the blood, in another in a gland and in a third in both situations. Fly were scarce but general, in every instance *G. morsitans*. Many villages were visited. Notes on other diseases met with are added.

Dr. Leach visited Kakumbi's village, in the Loangwa valley on the route between Fort Jameson and Serenje. Of 123 natives examined two were found to be infected. The disease was known to the natives as "mallali" and six persons were reported to have lately died of it. Other villages were therefore visited and a total of 392 persons examined. Ten cases in all were detected, a percentage of about 2·5; all lived within a short distance of the Loangwa; fly was scarce. The diagnosis was made as a result of gland examination in three instances, blood in three, and both in one. One patient was "an ancient man; thin, shrivelled, doddering; a picture of extreme old age." Two others are described as old. Most were said to have "mallali." In this disease persons "become thin and weak. After a time their feet and lower part of their legs would swell and they would be unable to walk. Their bellies would swell. They might eat a great deal or very little. They preferred to lie in a hut and sleep rather than be

outside and they lost interest in local affairs." The majority of cases were chronic. Reckoning cases that had died and early undetected ones Leach would put the percentage at 5 rather than 2·5. The disease here is believed to be recent.

[The Native Commissioner of Petauke has given an account of a disease called "chilotera" in the Loangwa valley, which corresponds in some respects to the account quoted above (see *Sleeping Sickness Bulletin*, Vol. 3, p. 276); it is said to have been long known in the valley. There is a natural tendency to assume that cases of human trypanosomiasis contracted in *morsitans* areas south of 12° S. are all attributable to *T. rhodesiense* (or *T. brucei*). The symptoms described by Leach are suggestive of *T. gambiense* rather than the other infection and, seeing that *G. morsitans* is under laboratory conditions an efficient transmitter, there is no valid reason why the two forms of the disease should not exist side by side. They cannot be distinguished with certainty without inoculation of animals].

A. G. B.

Sudan Sleeping Sickness Commission. **Annual Report on Sleeping Sickness for the Year ending September 30th, 1914.** [Dr. H. Bray]. MS.

Among the changes of staff one notes the death of Captain H. S. Ranken, V.C., Senior Medical Officer at Yei; a report by Captain Ranken, and an account of his treatment of sleeping sickness patients by metallic antimony were summarised in the *Bulletin* (Vol. 1, pp. 507 and 663). It is noted that the Yei sleeping sickness camp had an average strength of 383 throughout the year, but is not now the centre of the most heavily infected district; there were only 24 admissions, against 140 the year before. Selected cases receive passes to visit their villages for periods within one month. It is still necessary to employ human carriers on the Rejaf-Libogo road as other forms of transport are insufficient. The Kajo-Kaji district is now the most heavily infected; villages 18 miles south of this place (on the Nile, nearly opposite Nimule) contained most of the cases. A new camp is being built in this region, to take 300 patients. The villages will be shifted.

Three cases were found in the Nimule district (South Eastern Mongalla). It is believed that there are others. [When the reviewer was stationed at Nimule in 1901–02 an old Sudanese soldier attended the dispensary with obscure nervous symptoms which the reviewer has since recognised as those of sleeping sickness. He has little doubt that this man was in an advanced stage of the disease.] Details are given of the precautions on the borders of French and Belgian Congo, within which are many infected cases. It is noted that 90 per cent. of immigrants avoid the inspection post at Raga and enter elsewhere. An additional medical post is recommended. The expenditure on sleeping sickness prevention in the last year was £5,520. Details of the work done at Yei camp and district are given by Captain J. T. Simson.

AUBERT (P.). **Essais de Traitements de la Trypanosomiase Humaine avec un Dérivé O1 du Diaminoarsénobenzène.**—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 74–77.

The author at Brazzaville has employed O1 in the treatment of human trypanosomiasis [this *Bulletin* Vol. 4, p. 258]. It was given intravenously, in one in thirty parts of distilled water, to seventeen patients, fifteen of whom had not had previous treatment; the state of nine patients is described as *assez bon*; the others were less favourable cases. The results are shown in a table, in which it is seen that the longest period of freedom from trypanosomes to date was 88 days. The smallest dose capable of driving the trypanosomes from the glands and peripheral circulation was 1–1·5 cgm. per kilo. Doses of 3 cgm. per kilo were badly borne, causing nausea and vomiting, and these symptoms were called forth more often by a second than by the first dose, though the interval was 24 to 38 days. The weight did not go up, as it is observed to do after atoxyl treatment. Five of fifteen cases in which the blood was examined by centrifugation had a relapse a short time after treatment. Three of these had received the dose shown above to be toxic. [The results so far obtained with this product do not show that it has any advantages over arsenophenylglycin.]

A. G. B.

i. AUBERT (P.) & MICHELLI (M.). **Essais de Traitement des Infections Expérimentales à *Trypanosoma gambiense* et *dimorphon* avec des "Suspensions Huileuses d'Arsenic et d'Antimoine" (Métoléine). Note Préliminaire.**—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 28–30.

ii. LAVERAN (A.). **Le Dérivé O1 du Diaminoarsénobenzène dans les Trypanosomiases du Chien et du Cobaye.**—*Ibid.* pp. 31–32.

iii. MESNIL (F.) & MOTAIS (F.). **Sur l'Action Trypanocide *in vivo* d'un Dérivé (OK1) du Diaminoarsénobenzène.**—*Ibid.* pp. 32–34.

i. Under the name "Métoléine," DEGUY and LESURE have recommended the employment of finely pulverised metals or metalloids in oily suspensions which can be introduced into the organism intramuscularly. The authors have tested a small quantity of these substances—arsenic metolein, which contains 8 per cent. of arsenic, and antimony metolein, which contains 20 per cent. of antimony. In the first series of experiments two guinea-pigs infected with *T. gambiense* were treated with arsenic metoleine; in the second two guinea-pigs infected with *T. dimorphon* were treated with antimony metoleine; a guinea-pig was left untreated as control in each case. The details are given. It was concluded that in these cases there was a marked trypanocidal effect, that there was no reaction at the site of injection, that the particles of the metals were taken up by the large mononuclears, the process beginning about the fourth day after injection. Absorption was very slow; in one guinea-pig almost the whole of the arsenic was found in the tissues 96 hours later.

ii. The author and ROUDSKY published in 1914 the results of the treatment of mice infected with various species of trypanosomes with the derivative O1 [this *Bulletin*, Vol. 4, p. 258]. In the experiments

here described five dogs infected with *T. congolense*, *T. gambiense*, and *T. soudanense* were treated with intravenous injections of this substance. Of three dogs infected with *T. congolense* two recovered after six to eight injections and were well five months later. The third dog succumbed after a "prolonged survival." In the dogs infected with the other trypanosomes the improvement was only temporary. It was noted that the doses used were small. In the case of guinea-pigs injected under the skin or in the muscles, there were severe local symptoms so that the experiments could not be followed up. However, in one case a rabbit infected with a strain of *T. gambiense* refractory to atoxyl was treated with this substance and the trypanosomes disappeared for 57 days.

iii. This paper deals with another derivate of diaminoarsenobenzene, OK 1 prepared by Oechslin. The experiments were interrupted by the outbreak of war. The substance is a yellowish powder which keeps well in air and is very soluble in distilled water. Subcutaneous inoculations were well borne. Several mice infected with *T. brucei* and *T. gambiense* were treated and recovered; the dose employed was one half the lethal dose. The same results were obtained with the same doses of arsenophenylglycin. Experiments were then tried on rats, in which infection is more difficult to overcome. The trypanosome was *T. gambiense*. The rats had not relapsed at the end of the month, when they were killed. The same results were obtained with arsenophenylglycin. The experiments show that this product is not inferior to arsenophenylglycin and is superior to it in its stability in contact with air. Only experiments on man can tell if it can be substituted for arsenophenylglycin. OK 1 was shown to be active in mice on *T. rhodesiense* resistant to atoxyl.

A. G. B.

Lafont (A.) & Dupont (V.). **Action comparée, *in vivo*, chez le Rat Blanc, de l'Atoxyl, du Salvarsan, du Néosalvarsan, du Galyl et du Ludyl sur *Tr. gambiense* et *Tr. rhodesiense*.**—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 37–46.

The experimental animal was the white rat, of which 115 were used, 69 infected with *T. gambiense* and 46 with *T. rhodesiense*. Five or six animals were inoculated at a time and the arsenicals were introduced subcutaneously as soon as parasites were very numerous in the blood. The life duration of untreated rats was ascertained to be 12 days for *T. gambiense* and 10 for *T. rhodesiense*. The protocols of the experiments follow. If the minimum dose required to cause the definitive disappearance of parasites be considered the sterilizing dose, the following table shows the results:—

	T. rhodesiense.	*T. gambiense.*
Atoxyl ..	Above 20 cg. per kg. ..	From 15 to 18 cg. per kg.
Salvarsan ..	From 1 cg. to 1·5 cg. per kg.	From 0·75 to 1 cg. per kg.
Neosalvarsan	From 1 cg. to 1·5 cg. per kg.	From 1 cg. to 1·5 cg. per kg.
Galyl	From 0·75 to 1 cg. per kg...	From 0·50 to 0·75 per kg.
Ludyl ..	From 1·5 to 2 cg. per kg. ..	From 0·75 to 1 cg. per kg.

It is seen that *T. rhodesiense* is a little more resistant to the arsenicals than *T. gambiense*; that the arsenobenzenes are 10–15 times as active as atoxyl, whereas their toxicity is only one-and-a-half to twice as great; and that of the four arsenobenzenes galyl is the most active. In order to make sure of this last point another series of experiments was performed. These showed that whereas a certain dose of salvarsan, neosalvarsan and ludyl did not lead to the disappearance of *T. gambiense* from rats' blood, the same dose of galyl banished them from four to eight days; moreover, the period of survival in the case of galyl was greater than in that of the other three drugs. The authors favour further experiments, especially with galyl, with a view to its employment in human sleeping sickness.

[These authors have already recorded such employment; see this *Bulletin*, Vol. 3, p. 410, and Vol. 4, p. 257.]

A. G. B.

Seidelin (Harald). **Experiments with Salvarsan-Copper in Trypanosomiasis.**—*Ann. Trop. Med. & Parasit.* 1915. Mar. 18. Vol. 9. No. 1. pp. 197–200.

Salvarsan-copper (K_3) was tested on white rats, infected with a strain of trypanosomes of the *T. brucei* group kept in guinea-pigs and rats in West Africa. The best results were obtained with the injection of a dose of 0·0064 gm.; in such a case the trypanosomes disappeared from the blood on the following day and remained absent for 15 days, death occurring on the 28th day; in several other cases the life of the animals was prolonged for a few days more. It appeared probable that repeated injections of smaller quantities would have given better results. The author's object was to see if a real *Therapia sterilisans magna* could be established; in this he failed. A larger dose led to the death of the animals. The stage of infection at which treatment was undertaken proved to be of little importance. The experiments and their results are shown in a table. Untreated animals infected with this strain died in from eight to 17 days. The greatest period of survival in the experiments seems to have been 33 days. Reference is made to Vandenbranden's paper on the use of this drug in human trypanosomiasis [see this *Bulletin*, Vol. 3, p. 167].

A. G. B.

Sergent (Edm.), Lhéritier (A.) & Landes (L.). **Absence d'Immunité Héréditaire à l'Egard du *Trypanosoma soudanense* chez un Chevreau né d'une Chèvre immunisée envers ce Trypanosome.**—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 73–74.

This paper is complementary to that of Laveran, who showed that kids born of goats immune to *T. evansi*, the trypanosome of debab, *T. congolense*, and *T. gambiense*, were not themselves immune to these trypanosomes [see this *Bulletin*, Vol. 5, p. 99]. A goat immune to *T. soudanense*, after an infection of eight months, gave birth to a kid. This kid was inoculated two-and-a-half months later, contracted an infection of the same duration as its mother, and like her acquired immunity.

A. G. B.

VIALATTE (Ch.). **Au Sujet d'un Trypanosome du Chien observé dans le Sahara Oranais.**—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 70–72.

Reports were received of the occurrence of an undetermined disease among dogs, with fatal termination, at Beni-Abbès in South Oran. Later, the author himself observed a case and found trypanosomes therein. Some of the symptoms were intermittent fever, emaciation, paralysis of the hind quarters and opacity of the cornea. The number of trypanosomes found in the blood varied at different times.

The trypanosome averaged 18μ in length, varying between 17μ and 24μ. Its breadth was 1·5μ to 2μ. The free portion of the flagellum was as 3μ to 5·5μ long.

Debab in dromedaries is enzootic in the region. Morphologically, the trypanosome found in the dog closely resembled *T. soudanense* var. *berbera*, the causal agent of debab.

Various experiments are in progress to determine the identity of the trypanosome.

H. B. Fantham.

MINCHIN (E. A.) & THOMSON (J. D.). **The Rat-Trypanosome, *Trypanosoma lewisi*, in its Relation to the Rat-Flea, *Ceratophyllus fasciatus*.**—*Quarterly Jl. Microscop. Sci.* 1915. Jan. Vol. 60. Pt. 4. No. 240. pp. 463–692. With 10 plates and 24 text figs.

This interesting and detailed memoir of 230 pages gives a fully illustrated account of the authors' work—extending over five years—on the life-cycle of *Trypanosoma lewisi* in the rat flea. Previous papers on the subject have already been reviewed in this *Bulletin*, and as it is quite impossible to give an adequate summary of the memoir in the space at disposal, it must suffice to indicate the chief sectional headings.

The memoir is divided into three parts—"introductory," "the development of *T. lewisi* in the flea," and an "experimental study of the problems of transmission and development." The headings of the sections of the last part form an instructive and useful summary, thus :—

"(I.) *Trypanosoma lewisi* is transmitted from rat to rat by the rat-flea, *Ceratophyllus fasciatus*.

"(II.) The transmission takes place by the cyclical method. Transmission by the direct method has not been proved to occur.

"(III.) The trypanosomes make their appearance in the blood of the rat five to seven days after infection; the multiplication of the trypanosomes in the blood of the rat comes to an end 11 to 13 days after infection.

"(IV.) The cycle of development in the flea requires a minimum of five days for its completion.

"(V.) Transmission is never effected until the developmental cycle is completed; that is to say, until at least five days have elapsed since the first exposure of the fleas to infection.

"(VI.) The infection of the rat is brought about by the small trypanosome-form, which is the final form of development.

"(VII.) The final infective form of the cycle is developed first in the rectum on the fifth day of the developmental cycle, but may appear later in the stomach.

"(VIII.) The developmental forms of the trypanosomes in the flea are not infective when inoculated into the rat during a period extending from a short time (half-an-hour ?) after being taken up by the flea until the developmental cycle is complete.

"(IX.) The flea, when once it has become infective, remains so for a considerable length of time.
"(X.) The trypanosome does not penetrate into the salivary glands of the flea, but is confined, during its whole development, to the digestive tract.
"(XI.) The rat can become infected by eating infected fleas, but not until the developmental cycle of the trypanosome in the flea is completed.
"(XII.) Infection of the rat is effected contaminatively, by way of the rat's mouth, by the rat licking from off its fur or skin the moist faeces of infective fleas containing the final propagative form of the cycle.
"(XIII.) Can the flea infect the rat by inoculating the trypanosomes into it through the proboscis? [The authors' answer is in the negative.]
"(XIV.) Hereditary transmission of the trypanosome from flea to flea does not, in our experience, take place.
"(XV.) The trypanosomes in the blood of the rat can render fleas infective very soon after they make their first appearance in the blood, before their multiplication period is over.
"(XVI.) The trypanosomes succeed in establishing themselves in the flea and rendering it infective to the rat in only a small proportion of the fleas (*Ceratophyllus fasciatus*) that ingest them.
"(XVII.) Can the first phase of the development of the trypanosomes, namely, the intra-cellular multiplication in the stomach of the flea, continue beyond the second feed of the flea (counting as the first feed that by which it became infected)? [The answer to this question must remain open, so far as the authors' experiments are concerned.]
"(XVIII.) Starvation of the flea during the incubation period of the cycle does not inhibit, nor does it necessarily retard, the developmental cycle of the trypanosome in the flea.
"(XIX.) Starvation of the flea following immediately on an infective feed favours the establishment of the haptomonad [attached crithidial] phase in the rectum, while starvation begun after the incubation period in the flea is over, favours migration to the post-pyloric end of the intestine and the establishment of the haptomonad phase there."

There are also notes on the histological structure of the stomach of the flea and on various parasites of fleas.

The trypanosomes parasitise the fully formed, but still young and vigorous, cells lining the flea's stomach. The flagellates were not found within the cells of the epithelial crypts of that organ. As the parasitised cells become exhausted and destroyed they tend to be thrown off from the epithelium

The last plate consists of a diagram of the life-cycle of *T. lewisi* in the rat flea.

H. B. F.

DELANOË (P.). **Au Sujet des Trypanosomes du Type *T. lewisi* Kent rencontrés chez des Muridés dans la Région de Bouaké (Côte d'Ivoire).**—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 80–88. With 2 plates.

The author has examined recently 600 rodents captured in the neighbourhood of Bouaké, Ivory Coast. In the present paper he describes three new trypanosomes.

1. *Trypanosoma arvicanthidis* (called *T. arvicanthi* in the earlier part of the paper), a variety of *T. lewisi*. The flagellate was found in striped rats, *Arvicanthis barbarus* and *Arvicanthis barbarus pulchellus*.

Fifty-three of these rats were examined, and seven were found to be infected. *T. arvicanthidis* averages 28μ in length (varying between 25μ and 31·5μ) and 1·8μ in breadth (varying between 1·2μ and 2·5μ). The free portion of the flagellum averages 6μ. The parasite can only be inoculated into young rats with difficulty. It is inoculable into "rats savanes," allied to *Arvicanthis niloticus richardi*. Two young *Golunda campanae* were successfully inoculated, but a young guinea-pig was refractory. The parasite may be allied to *T. avicularis* found by WENYON in a striped mouse in the Anglo-Egyptian Sudan.

2. *T. eburneense*, n. sp., found in the blood of *Mus concha*. Nine of the rodents were found to be infected out of 66 examined. Of 36 parasites measured the average length was 34·9μ. The trypanosome appears to be pathogenic to its natural host. *Golunda campanae* are inoculable, but white rats are refractory. A young guinea-pig inoculated intraperitoneally showed infection limited to the peritoneum. Three young *Xerus erythropus* were successfully inoculated.

3. *T. guist'haui*, n.sp., found in "rats savanes" [*Arvicanthis sp.*]. 128 of these rats were examined and 16 were found to be infected. The trypanosome was somewhat rare in the parasitised animals. Of 10 trypanosomes measured the average length was 44·7μ.

The various trypanosomes found are represented in two plates.

H. B. F.

ROUBAUD (E.). **Sur un Essai d'Élevage de Glossines dans les Laboratoires d'Europe.**—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 34–36.

In December, 1913, Roubaud brought to France from Senegal about twenty living pupae of *G. palpalis* and *G. morsitans*. The more mature were killed by the cold. From the rest a certain number of imagines emerged at the Pasteur Institute; Roubaud believes that these are the first to be introduced into Europe. [In December, 1909, a number of pupae of *G. palpalis* reached the Zoological Gardens, London, from Sir David BRUCE in Uganda. They were kept under not very favourable conditions. Two imagines emerged but did not survive (*Sleeping Sickness Bulletin*, Vol. 2, p. 46)]. They were placed in a Roux's incubator at 24–25°C. and fed every day on guinea-pigs or rabbits. The *palpalis* pupae produced two males only, the *morsitans* two males and six females. One of these formed the progenitor of twenty flies which existed a year later; that the number was no larger was attributed to the disturbance incident to mobilisation. The humidity was kept at 50–55 per cent. One fly lived 5½ months and produced 15 larvae. The pupation period in four cases was from 31 to 38 days. It is necessary to arrange for the renewal and circulation of the air in the incubator; for *G. morsitans* the percentage of humidity should not exceed 60. In June some of these flies were shown under glass at the Jardin d'Acclimatation in Paris. They were subject to the ordinary temperature, 10°–27°C., for more than a week. It appears then that they might survive in France through the summer months.

A. G. B.

Terry (B. T.). **The Influence that Serum exerts upon Trypanosomes, with Special Reference to its Use for Experiments *in vitro* with Atoxyl and Paraminophenylarsenoxyd.**—*Jl. Experim. Med.* 1915. Mar. 1. Vol. 21. No. 3. pp. 250–257.

The author published in 1912 a paper entitles "The Advantages for Certain Experiments *in vitro* of suspending Trypanosomes in Serum" (see *Sleeping Sickness Bulletin*, Vol. 4, p. 220). He now returns to the subject and adds to the points made in his former paper. His summary, which is a fairly complete account, is as follows:—

"1. Serum of various animals preserves the motility of nagana trypanosomes better and longer than salt solution.

"2. To act best in this way the serum should not be diluted more than two to four times. Undiluted serum is perhaps best.

"3. Serum filtered through a Berkefeld filter, bottled aseptically, and kept in the ice-box preserves this activating property apparently undiminished for many months.

"4. Serum preserves the motility of trypanosomes better than '*Salz physiologicum*' of Merck, and better than the Ringer solutions of Meltzer and Carrel.

"5. Serum preserves the normal morphology of trypanosomes better than the Ringer solutions tested.

"6. The infectiousness of trypanosomes suspended in cattle serum was preserved at room temperature for at least eight days.

"7. The vitality of the trypanosomes in serum was seemingly better preserved at room temperature than at ice-box temperature.

"8. Serum incubated with atoxyl does not transform it into a toxic substance.

"9. Serum does not bind paraminophenylarsenoxyd, for trypanosomes suspended in serum are often immobilized more quickly by paramino-phenylarsenoxyd than trypanosomes suspended in salt solution.

"10. Serum is suitable for suspending trypanosomes for certain experiments *in vitro*, and with proper precautions may be employed for transporting virus from laboratory to laboratory."

A. G. B.

Schilling & Goretti. **Ueber die Wirksamkeit von Lösungen von Arzneimitteln in Serum.** [The Activity of Solutions of Medicaments in Serum.]—*Zeitschr. f. Immunitätsforsch.* 1. Teil. Orig. 1914. Dec. 19. Vol. 23. No. 3. pp. 257–266.

Schilling and Schreck made the following observation on a horse which had a relapse of nagana. Salvarsan was given intravenously in a quantity of 21 mgm. per kilo body weight. About a minute after the last of the salvarsan had gone through the funnel and the remains had been rinsed through with salt solution, blood was removed through the same canula. The serum obtained from this blood when mixed with trypanosomes of the same strain proved to be highly parasiticidal. Experiments were therefore made in Berlin. It was seen then that it was not necessary to introduce the drug into the blood of the living horse; it was sufficient to use fresh horse serum as a solvent. Tartar emetic was employed. It was first dissolved in one per cent. salt solution and further dilutions were made with fresh horse serum. The technique is described. Decreasing quantities of tartar emetic were dissolved in fresh horse serum on the one hand and citrate bouillon on the other, and a suspension of *T. brucei* was brought into contact.

It was found that after three-quarters of an hour the trypanosomes in a 1:9,000 dilution of the drug in normal horse serum were quite immobilised, whereas in the control tubes, in which the tartar emetic was dissolved in bouillon, they were still completely motile. The experiment was then modified, the tartar emetic being dissolved in salt solution and the trypanosomes suspended in horse serum on the one hand and citrate bouillon on the other. A similar result was obtained. The authors say that the phenomenon can be very well observed if a drop of trypanosome suspension is brought in contact with a drop of tartar emetic plus serum, 1:3,000. The preparation is covered with a cover glass. Within a minute the trypanosomes begin to lose their movements and eventually they disappear. The phenomenon can be produced with inactivated serum also. The serum of cattle, goats and rabbits was not so effective as horse serum.

Experiments were then made to see if other drugs behaved similarly. With salvarsan, atoxyl and trypanred the effect was the same whether they were dissolved in citrate bouillon or in serum. It was found that serum mixed with an equal part of bouillon had a pronounced action; with greater dilutions the effect was less. The authors tested the serum of a foal which had been infected with nagana and freed from trypanosomes by injections of tartar emetic. The serum was protective for mice. In this series of experiments its parasiticidal property was not greater than that of normal serum, from which it may be inferred that the substance which killed the parasites in the mouse experiment is different from the substance which became active on the addition of tartar emetic. The authors find that tartar emetic dissolved in normal horse serum does not act better therapeutically than when dissolved in water or salt solution. They are unable to say how this heightening of the activity of tartar emetic comes to pass. They think the phenomenon has a certain relation to that observed by Levaditi, who showed that an emulsion of liver cells mixed with atoxyl became parasiticidal *in vitro*.

A. G. B.

MISCELLANEOUS.

James (S. P.). **Mosquito Work in Ceylon.**—*Trans. Soc. Trop. Med. & Hyg.* 1914. July. Vol. 7. Nos. 7 & 8. pp. 225–243.

Summary of a Year's Mosquito Work in Colombo.—*Indian Jl. Med. Research.* 1914. July. Vol. 2. No. 1. pp. 227–267. With a plan.

In the space at disposal it is difficult to give of this interesting paper the account which it merits.* The author was engaged by the Government of Ceylon to make a Stegomyia survey of her seaports, to study malaria in the island, and to assist in training a body of men to be employed as sanitary inspectors. He points out that active mosquito work must be preceded and accompanied by research, with a view to ascertain (1) the names of the species that are dangerous; (2) Distribution and prevalence of each species separately; (3) The life history and habits of each; and (4) The practical methods which, in view of the knowledge obtained under (1) to (3), will be most likely to bring about the reduction of the different species.

With regard to (1) 52 species were collected from Colombo alone – Stegomyia 5, Ochlerotatus 5, Culex 8, and Anopheles 8. Seventeen of the species were sufficiently prevalent to be a source of annoyance or danger, including four Stegomyia and Ochlerotatus, six Culex and three Anopheles.

With respect to prevalence and distribution, the author's experience was that the systematic enumeration of adults collected by hand catching in test tubes or in specially devised traps was the best method, and a great advance upon the usual practice of basing estimates upon an enumeration of breeding places. The description of a successful trap is as follows :—

"It consists of a rectangular wood framework, 5 ft. long, 3 ft. deep and 3 ft. broad, closed with mosquito netting, one end of the trap being a door on hinges. We place these traps on the ground in the shady corner of a garden, and cover them with sacking and a thick tarpaulin, so that the interior is dark and cool. Two or three pots of plants are put inside each trap and several near the door, which is left partly open. We set the traps over night, and the next morning, about nine o'clock, we send beaters through the vegetation in the neighbourhood of the traps, and we burn straw torches in all the surrounding buildings so as to drive the mosquitoes into the open air. The result is that most of them quickly find their way into the traps, which appear to them to be very attractive and cool resting-places. After completing the disturbance of vegetation and the smoking of surrounding buildings we close the door of the trap, and collect and count the imprisoned mosquitoes."

A tabular statement is given of the number of mosquitoes caught daily for 23 days in one of these traps. The average daily catch was 280, and on one occasion the catch was 826. The trap for anopheles was a movable mosquito-proof hut, each wall of which was provided

* Those who wish to study the details of this survey should obtain the "Report on a Mosquito Survey of Colombo and the Practicability of Reducing Stegomyia and some other kinds of Mosquitoes in that Seaport," by S. P. James, M.D., D.P.H., Major, Indian Medical Service. Assisted by W. T. De Silva, L.M.S., and E. W. Arndt, L.M.S. 64 pp. With 4 plans and 70 photographs. 1914. Colombo; H. C. Cottle, Government Printer, Ceylon. To be purchased at the Government Record Office, Colombo. Price, with Plans, &c., Rs. 2.

with a special trap similar to those used on the Panama Canal. For estimating the prevalence and distribution of *Stegomyia fasciata* test breeding pots were used. Of 168 pots distributed in March 14 per cent. became infected within 48 hours and 42 per cent. within 120 hours. The percentage of dwellings in which larvae are found being called the larval index for dwellings, the figure for *S. fasciata* was about 16, but this figure underestimates the real prevalence as many collections of water cannot be readily examined.

A study of the life history and habits of each species led the author to arrange the mosquitoes of Colombo in the following broad groups :—

(*a*) Urban mosquitoes Group 1 strictly household species, Group 2 other urban species.

(*b*) Rural mosquitoes Group 3 strictly sylvan, Group 4 migratory, Group 5 species with peculiar habits. Of Group 1 *Stegomyia fasciata* is the best example ; of Group 2, *Culex fatigans* ; Group 4, the migratory species are those which breed in swamps at a distance from centres of population and have the habit of flying long distances into towns to obtain meals of blood ; they include species of Culex and Anopheles. Some members of this group are of great interest and importance in Colombo. This migratory habit has been noted in the Panama Canal Zone and elsewhere. One of the members of Group 5 obtains its food from the mouths of ants.

As regards the practical methods of bringing about a reduction of the different species, five experimental anti-mosquito campaigns were initiated in different areas of the town. The author discusses the relative value of a scheme based upon legal powers and one carried out by voluntary action. A campaign of the latter kind is far more arduous and costly and meets with more opposition than a campaign based on legal powers. A thorough investigation was first made. The staff allotted to each area was frequently changed and independent investigations were held. For testing progress the following methods were employed :—

"*For Larvae.*

"(1) A continuous record of the number of potential and actual breeding places found in the areas at each investigation.

"(2) A periodical comparison of the number of actual breeding places found inside the area, with the number found in a similar control area just outside it.

"*For Adults.*

"(3) The opinions of members of the community resident in the area dealt with as compared with the opinions of those occupying the control area.

"(4) Enumerations of adult mosquitoes by hand catching and trap catching.

"(5) The use of test breeding places."

A tabular record is given of the potential and actual breeding places found between April and December in one area. The author thinks that the system of frequent changes of staff and independent investigation is a great aid to the discovery of breeding places, and points out that in an anti-larval campaign steps have to be taken to overcome the frailty of man as well as the wiliness of the mosquito. He writes :—

"One of our observations resulting from the institution of these precautions is of especial importance. It is that the elimination of breeding places which are easily accessible leads mosquitoes to discover places which are very difficult for ordinary human beings to find, and when

found are very difficult to destroy. This clever change in the habits of mosquitos greatly increases the difficulties of a campaign, and is one of the reasons why it is hardly possible, even for highly skilled workers, to exterminate mosquitoes, and why the brigades of voluntary untrained labour recommended in the popular books seldom effect a reduction in the number of adult mosquitoes, although they eliminate many of the more obvious breeding places."

A table shows that a diminished percentage of houses in which larvae were found in the area was accompanied by an increased percentage outside. From the middle of July it became difficult to collect specimens of *S. fasciata*, *S. scutellaris* and *C. fatigans*. Table 6 shows the reduction of *S. fasciata* as shown by the trap breeding pots.

TABLE VI.

Dates.	Percentage of test pots infected.	Dates.	Percentage of test pots infected.
25–7–13	41·6	13–9–13	12·5
30–7–13	33·3	18–9–13	8·1
4–8–13	33·3	23–9–13	4·1
30–8–13	29·1	30–9–13	8·1
4–9–13	17·0	6–10–13	4·1
9–9–13	17·0	—	—

In August, September and again in November a large number of migratory species entered the area so that the residents were obliged to resort to the use of curtains.

In conclusion, the author says that the task of reducing the mosquito pest and even *Stegomyia fasciata* must be regarded not as a trivial affair, but as a task of immense difficulty. He recommends for large seaports and cities the establishment of a special anti-mosquito department, consisting of a properly qualified entomologist and staff of trained workers provided with legal powers and liberal funds. Active measures must be accompanied by active investigation.

A. G. B.

ROPER (Richard). **An Account of some Anopheline Mosquitos found in British North Borneo, with Description of a New Species.**—*Bull. Entom. Research.* 1914. Sept. Vol. 5. No. 2. pp. 137–147. With 1 text fig. and 2 maps.

The observations were made during three years' estate medical work in British North Borneo. The climate, topography, etc. of the district in question are described. The spleen rates of the coolies on four estates and of the children in four villages were ascertained. It is noted that on one estate a coolie line, built on rising ground in the middle of an extensive swamp, was infested with malaria as long as there were large trees growing in the swamp, but became free as soon as the trees were felled. It is suggested that the large trees shielded the adult mosquitoes. It is a well-known fact, it is stated, that on a rubber estate so long as the trees remain small the malaria rate is small, but as the trees get large the malaria increases. There is a large amount of rice growing, but it is noted that cultivated rice fields do not seem to be a danger as regards malaria. In any jungle

or swamp land on the borders of estates, where search was made, anopheline larvae were found, most commonly those of *A. kochi*. The data show that the spleen rate of an estate coolie force corresponds to some extent to the spleen rate of the neighbouring village, and the amount of malaria to the proximity of swamp breeding malaria-carrying mosquitoes.

Ten species of Anophelines were obtained, eight in the neighbourhood of one estate. *A. brevipalpis* is described as a new species; the wings are unspotted. *A. kochi* was by far the commonest anopheline found in the district. The finding of *A. maculatus* is noted as of importance to the rubber estates in Borneo in view of the work of Stanton and Watson in the Federated Malay States on this species. *A. leucosphyrus* was constantly found biting coolies on one estate, malaria being common. In only one specimen could the stomach be dissected owing to the presence of blood. The author appears to think that this will prove to be a malaria carrier. *A. umbrosus* was very common; its larvae were frequently searched for, but were never found. Sporozoites of malaria were found in one specimen. The other species were *A. punctulatus*, *A. ludlowi*, *A. separatus*, *A. barbirostris*, and *A. albotaeniatus*. A. G. B.

Federated Malay States. **Report by the Travelling Medical Entomologist** (C. Strickland) **for the Year 1913.** 4 pp. f'cap. Printed by F. M. S. Govt. Press. Received Dec. 18th, 1914.

The author writes that his chief concern has been with the biology of the mosquitoes concerned in the transmission of malaria. He does not give details in this report but notes that he has about 2,500 field observations recorded. The biological work has been interrupted by a "millions" experiment, details of which are supplied, and by the formation of a Malaria Bureau and Bureau of Medical Entomology. From 800 to 1,000 "millions" arrived from the West Indies on July 30th and were placed in a large tank in the experimental gardens at Kuala Lumpur. A few days later they were transferred to natural waters presenting diverse features, but at the same time answering as closely as possible to the characteristics of their natural West Indian habitats. Nevertheless, in all these places they seemed to dwindle or disappear. This being the case, it was determined that those which remained should be saved and nursed until they should become so plentiful that a balance of power on their side could be established. About 150 were recovered and put with a reserve originally placed in the plant-house tank. Later it was thought that the fish put in a certain lakelet were naturalising themselves. Other experimenters are advised to adopt the following system on the arrival of a consignment of fish :—

"1. Place them in a large tank made of rock or some material through which there is some drainage, and through which there is running water, but in which there are no other fish. It should also be partly in shade.

"2. When they are increased to a large number, an event which can be hastened by feeding them on egg, oatmeal, or chopped meat once a week, place them out in the natural waters in which it is hoped to establish them, but at first inside a pagar of fine wire.

"3. Finally the pagar can be removed."

It is now proposed that the author should make a complete survey of the distribution of Stegomyia in Malaya. A. G. B.

Dixon (Samuel G.). **The Duck as a Preventive against Malaria and Yellow Fever.**—*Jl. Amer. Med. Assoc.* 1914. Oct. 3. **Vol. 63. No. 14. p. 1203.**

The author states that the duck is one of the greatest known enemies of the mosquito and therefore of yellow fever and malaria. He built two dams near together on the same stream, each covering nearly 1,400 square feet. In one, twenty mallard ducks (*Anas platyrhynchos*) were permitted to feed, while the other was protected from waterfowl but well stocked with gold fish. The one in which the ducks fed was for several months quite free from mosquitoes, while the protected pond was swarming with young insects in different stages. To the infested pond ten well-fed mallard ducks were then admitted; at the end of 4 hours no pupae were to be found and in 48 hours only a few small larvae survived. For some years the author has used ducks to keep down mosquitoes in swamps that would have been very expensive to drain.

In the issue of the same journal for October 17th, Dr. W. C. Herman writes that he has observed the food of the wild duck for the last three years and finds that the mosquito and larvae are readily devoured by it. The best species for this purpose are the wood duck, *Aix sponsa*, which in nature is almost extinct, and the green-winged teal, *Nettion carolinensis*.

Commenting on this paper in the *Lancet** of December 5th, 1914, Dr. A. Balfour refers to the writings of Beutenmueller (1890), Weeks (1890), and a Supplication "presented over a hundred years ago to the Sacred Tribunal in Rome by the Commune of Marsciano, Umbria, asking for a papal decree prohibiting the killing of nesting swallows for food because the destruction of these birds brought about the deterioration of the air, and hence insalubrity in the region."

A. G. B.

Seidelin (Harald) & Summers-Connal (Sophia). **Notes upon the Biology of** *Stegomyia fasciata.*—*Yellow Fever Bureau Bull.* 1914. Sept. 30. Vol. 3. No. 3. pp. 187–192.

The authors refer to the explanation offered by Marchoux and Simond of the apparently contradictory observations that yellow fever is transmitted at night time only whereas the female *Stegomyia fasciata* bite at any time during day or night: namely that young females of *S. fasciata* when sucking blood for the first time bite indiscriminately day or night, but later on only during the hours of twilight and darkness. With the purpose of contributing to the study of this problem they isolated four females of *S. fasciata* in a cage and fed them for weeks at various hours on the arm of one of them. One or more males was always present. Full details are given. The experiment lasted from November 11th to January 18th, when the last mosquito was found dead. The experiment appeared to show that females of *S. fasciata* bite indiscriminately at day time and after dark. They anticipate and meet objections that the experimental conditions did not correspond with those in nature. They compare their experiment with that of

* "Birds and Malaria," p. 1,326.

Marchoux and Simond, which they criticise. They write that they cannot believe that this theory is correct and suggest that the dogma of the non-transmission of yellow fever during the day may be wrong.

A. G. B.

Marzinowsky (E. I.). **De l'Existence de *Stegomyia fasciata* (*St. calopus*) en Russie.**—*Bull. Soc. Path. Exot.* 1914. July. Vol. 7. No. 7. pp. 590–593.

The author, who took part in an expedition for the study of malaria sent to Batum, on the Black Sea, by the Pirogoff Society, found in that place a large number of *Stegomyia fasciata*. The same species was found later at Poti, to the north, by another member of the expedition. The author points out that Clarac and Simond in their monograph on yellow fever note the existence of *S. fasciata* in Spain, Portugal, Italy, Greece, and Crete. It is met with between 40° north and 40° south latitude. He notes that Batum is at 40° and Poti 42·2°. The distribution of these insects in the Mediterranean shows that they have been brought by steamboats to the Black Sea ports. At Batum in winter the thermometer goes down to 6·6°. He thinks it certain that the mosquitoes hibernate in the larval state and notes that Clarac found larvae in water that was scarcely 5°. He thinks that the existence of *S. fasciata* on the shore of the Black Sea is a permanent danger for Russia; yellow fever might at any time be imported by boats coming from South America. He has been informed that Dr. Gourko found *S. fasciata* at Tiflis, to which place it must have been imported from Batum by rail.

A. G. B.

Wheeler (William Morton). **Ants and Bees as Carriers of Pathogenic Micro-Organisms.**—*Amer. Jl. Trop. Dis, & Prevent. Med.* 1914. Sept. Vol. 2. No. 3. pp. 160–168.

In this paper, the author states, he gives expression to conjectures based on observation of certain insects which he believes will eventually occupy much more of the attention of sanitarians and entomologists in the tropics. He discusses the habits of the cockroach. Nearly all the species are thermophilous and are therefore confined to tropical or sub-tropical countries. Owing to their feeding habits and lurking places they must carry hosts of germs about, both in and on their bodies, and be able to infect food. The only evidence, however, is that collected by Longfellow, who found that one of the cockroaches of the United States could carry various micro-organisms on its legs and that the same could be cultivated from the faeces.

He mentions many species of ants which live near or in dwellings in the tropics. He states that *Monomorium destructor* is gravely suspected of being a disseminator of bubonic plague in India. The only other reference he has been able to find is to a paper by Darling. Darling found that when ants were immersed in broth culture of *B. typhosus* they were able for 24 hours to infect culture media over which they crept. He was unable to find typhoid bacilli or any other micro-organism in the intestinal tract and assumed that this was owing to the germicidal action of formic acid. The author points out

that formic acid is not secreted in the alimentary canal of the ant and in any case is produced only by certain genera and species. He gives an interesting account of the ant's method of feeding :—

"Ants live only on liquid food, either imbibed directly or sucked out of minute solid or semi-solid particles which have been rasped off by the tongue and pressed into a little pocket on the ventral side of the pharynx. The liquid thus expressed passes back through the oesophagus into the crop, or "social stomach," so called because it may thence be fed by regurgitation to other ants or to the larval brood. Later the little dry pellet is spit out of the subpharyngeal pocket. This pellet also contains the dirt scraped by the ant from its own legs and body by means of the tibial strigils, or combs, which are cleaned from time to time by being passed through the mouth. Hence the pellet may contain all kinds of micro-organisms and fungus spores collected from the outer surface of the body in addition to any that may have been contained in the solid food. As the ants may drop the pellets anywhere, even into the human food they are so fond of visiting, infection may result. . . . Under no circumstances would the micro-organisms necessarily come in contact with the formic acid of the ant's repugnatorial glands. It would seem to be possible, therefore, for ants to spread disease germs in three different ways: First, by simply walking over or into human food, as DARLING has shown; second, by dropping into it infected hypopharyngeal pellets, and third, by contaminating it with their germ-laden feces."

He gives an account of the habits of *Solenopsis geminata*, a small ant which is abundant in the tropics of both hemispheres. It stings so severely that in the West Indies it is commonly known as the "fire ant." It is a common tenant of the gardens in the patios of houses in Latin America. The author on one occasion found a number of nests of this species containing large numbers of full-grown fly larvae. He followed the ants and found that these larvae were extracted from masses of human excrement by the edge of the camp. As he says, the ants could hardly fail to transfer such organisms as *B. typhosus* or Entamoeba from faeces in which they might occur to any exposed food in the immediate vicinity.

He cites some habits of the stingless bees of the genus *Trigona*. These build in hollow tree trunks, or in the ground, nests of wax secreted by themselves and kneaded up with foreign substances; some species use moist earth, others the faeces of animals or man. Honey is stored in the cells and eagerly collected by man for food; it may very well be contaminated.

A. G. B.

BACOT (A. W.). **The Influence of Temperature, Submersion and Burial on the Survival of Eggs and Larvae of** *Cimex lectularius*.— *Bull. Entom. Research.* 1914. Sept. Vol. 5. Pt. 2. pp. 111–117.

These experiments were performed to determine whether it was possible that the eggs of the common bed-bug could survive the process of house destruction when the plaster from old walls, on which eggs had been laid, had been broken down and mixed with fresh mortar for making the partitions of rooms in new tenements. The methods are detailed.

The conclusions are as follows :—

"Eggs.—

"*Temperature.* Eggs of *Cimex lectularius* are able to survive exposure to temperatures between40° and 50° F. for periods of 31 days, and between 28° and 32° F. for 48 hours. Periods of from 5 to 8 days at the

latter temperature reduce the percentage hatching to 25 per cent. and longer exposures—10 to 15 days—are fatal. Temperatures between 60° F. to 98° F. are favourable, but 113° F. prevents hatching.

"*Burial in Sand.* Burial in dry or wet sand, with exposure to temperatures between 45° and 50° F. may be survived from four days to a week if the eggs are then uncovered and kept at a favourable temperature.

"*Submersion in Water.* Submergence in water at between 60° and 63° F. for a period of five days has no effect on hatching if the eggs are subsequently kept under favourable conditions. They also survive for at least three days in water at between 45° and 50°, and for 48 hours when the water in which they are submerged is frozen.

"*Lime-water.* Submergence in lime-water (saturated solution) for 46 hours is fatal. The eggs survive partial embedding in a wet plaster surface provided that emergence is not interfered with.

"Larvae.—

"Newly hatched bugs, when unfed, can survive a temperature of from 28° to 32° F. for periods up to 18 days. They are also able to withstand chilling, thawing, rechilling and again thawing over shorter periods. When subjected to cold, moist air after a full meal they are liable to a heavy or even total mortality—probably in consequence of humidity rather than cold.

"Under moderate conditions of temperature—60° to 65° F.—they may live for 136 days unfed, and after a meal, for nine months. Unfed, at a temperature of 75° F., with humidity between ·65 and ·70, an average life of 10 days, and an individual survival of up to 21 days is possible. At 88° F., with humidity between ·70 to ·80, the average life is shortened to 7 days—the longest survival being 11 days. At 96° F., with humidity at ·25 the average life is reduced to 5 days; individuals have survived for 8 days. Exposure to 113° F. is fatal within a few minutes."

A. G. B.

Cornwall (J. W.) & Patton (W. S.). **Some Observations on the Salivary Secretion of the Commoner Blood-Sucking Insects and Ticks.**—*Indian Jl. Med. Research*, 1914. Oct. Vol. 2. No. 2. pp. 569–593. With 2 charts.

The authors discuss previous speculations and investigations as to the exact means by which local irritation of the skin is produced by biting insects, quoting Leeuwenhoek, Reaumer, Nuttall and Shipley, Schaudinn, and MacLoskie, and come to the conclusion that "in the case of the mosquito at least, some doubt still exists as to the exact function of the salivary secretion." The observations recorded in this paper were carried out to elucidate the following points:—

"(1) Whether the salivary glands of some of the commoner blood-sucking insects contain a substance which retards the coagulation of blood, and whether immunity against the anti-coagulin follows a long course of subjection to the bites of any particular insect, and whether such immunity can be produced by artificial means?

"(2) Whether this anticoagulin is the substance which causes the irritation following a bite; if not, to what is the irritation due?

"(3) Whether variations in the nature of the salivary secretion of different biting flies, considered together with their respective habits and the structure of their mouth parts, can throw any light on their position in a scheme of classification"

The experiments were carried out chiefly with *Philoematomyia insignis*, one of the commonest biting muscids in India, also with three blood-sucking species of Musca, two species of Stomoxys, a Tabanus,

Anopheles rossi and *A. jamesi*, *Cimex rotundatus*, *Conorhinus rubrofaciatus* and *Argas persicus*. The conclusions, in part, are as follows :—

" 1. The salivary secretion of *Philamatomyia insignis* when first extracted from the glands is a colourless fluid, but after exposure to the air for about half an hour it turns black ; this reaction is due to oxidation which results in the formation of a pigment. The secretion contains a powerful anticoagulin ; emulsion of the salivary glands from one fly will delay the coagulation of 0·025 cc. of calf blood for 20′ while the emulsion from the salivary glands of from 3 to 5 flies will prevent coagulation of the same quantity of blood altogether. The formation of the pigment does not affect the anticoagulative property of the fluid. When allowed to dry for short periods the power of the anticoagulin is unimpaired, but if kept for long periods it loses its power. If absolute alcohol is allowed to act on the dried emulsion the anticoagulative power is unchanged. Glands soaked for a short time in ether, dilute acid and dilute alkali partially lose their anticoagulative power. The anticoagulin is insoluble in ether and therefore is not a lipoid. Heating the emulsion for 10′ to 100° C. does not destroy the anticoagulin.

" 2. The anticoagulin from the salivary glands of the male *insignis* is weaker than that from the female and it is less active in recently hatched flies of both sexes.

" 3. The mesenteron of *Ph. insignis* contains a powerful coagulin which is readily destroyed by heat ; the coagulin is most active in flies from 20 to 44 hours after their first feed of blood.

" 4 Inoculations of the salivary emulsion of *Ph. insignis* into a white rat does not result in the formation of an anti-body in its blood. Sera from the calf, rat and rabbit not so treated all contain some substance which inhibits the action of the anticoagulin ; that of the calf appears to be the least potent of all.

" 6. The salivary glands of *Tabanus albimedius* contain a powerful anticoagulin, so also those of *Anopheles rossii* and *A. jamesi* ; the secretion of the last two flies causes immediate agglutination of the red blood corpuscles. The emulsion of oesophageal diverticula of *A. jamesi* does not contain any anticoagulin.

" 10. Small quantities of the emulsion of the salivary glands of *A. jamesi* and *A. rossii* injected into the human skin cause small hyperaemic patches around the puncture and a wheal develops at its site ; no irritation is produced. The hyperaemic patches are probably due to the blocking of capillaries by the agglutinated red corpuscles. Small quantities of the emulsion of the oesophageal diverticula injected into the human skin produce a wheal and some hyperaemia but no bloody patches ; there was a slight irritation at the site of puncture in the case of one of the subjects. Sterile salt solution injected into the human skin produces a wheal and some hyperaemia.

" 11. The salivary secretion of *Philaematomyia insignis* does not produce any irritation when injected into the human skin ; some hyperaemia and a wheal develop at the site of the puncture.

" 12. The secretions from the ovoid salivary glands of the bed-bug and of *Conorhinus rubrofasciatus* probably cause the irritation following the bites of these insects.

A. G. B.

GORGAS (W. C.). **Recommendation as to Sanitation concerning Employees of the Mines on the Rand made to the Transvaal Chamber of Mines**—*Jl. Amer. Med. Assoc.* 1914. June 13. Vol. 62. No. 24. pp. 1855–1865.

Surgeon-General Gorgas visited Johannesburg in December, 1913, at the invitation of the Chamber of Mines, to investigate the cause of the high death rate from pneumonia among the native labourers working in the mines of the Rand. He found that during the year

1912 for about 300,000 natives employed in mines and industrial works in the proclaimed government district of the Transvaal, the death-rate was 26·84 per mille, of which 9·8 was due to pneumonia. Pneumonia was found to vary greatly according to the locality from which the natives came, being highest amongst those from Nyasaland and lowest in those from the Cape Province; 21,000 natives from tropical areas had a pneumonia death-rate of 26·3, and 199,000 natives from non-tropical areas a rate of 8. It is concluded that a community which has a large proportion of tropical natives will have a high pneumonia death-rate, and a community which has a large proportion of non-tropical natives a low pneumonia death-rate.

It is everywhere asserted at the mines that the new boy has a much higher rate of pneumonia than the old boy. MAYNARD found that the pneumonia rate was 15·83 per thousand during the first six months, 9·01 during the second six months and 5·31 during the third. The same is brought out well in a table of deaths according to month of service. Gorgas states that the uniformity with which pneumonia attacks the new boy or recently arrived native is as pronounced on the Rand and in Rhodesia as it was in the Isthmus of Panama, which indicates that the question of immunity is the most important element in the causation of the death-rate. In the construction of the Panama Canal there was much the same trouble with pneumonia among the negroes, the bulk of whom came from Jamaica and Barbados. A table shows the death-rate from 1906 to 1913.

TABLE 2.—DEATH-RATE AMONG NEGROES.

Year.	Death Rate.	Year.	Death Rate.
1906	18·74	1910	1·66
1907	10·61	1911	2·24
1908	2·60	1912	1·30
1909	1·66	1913*	0·42

A board was appointed to examine into the matter. There was found to be no particular relation to season nor to wet clothes; the men who slept in dry clothes had as much pneumonia as those who slept in wet. The difference in susceptibility was shown to be governed by the length of time that the labourer had been on the Isthmus. Pneumonia was found to be four and a half times as frequent among men who had been on the Isthmus less than three months as it was among men who had been on the Isthmus more than three months. The drop in the death-rate shown in the table is thus explained.

"During the first few years on the Isthmus, we housed our negroes in barracks containing about eighty-four men each, and of such dimensions as to give them about 30 feet of floor-space. This is ordinarily considered very crowded. In 1907 we allowed our negro labourers to scatter out along the line of the Canal, build each man his hut, with a small cultivable piece of land, and bring over his family. In 1910 our negro force was 37,000. Of this force, only about 7,000 lived in barracks; the other 30,000 lived in their own establishments. To this fact of scattering I attribute the disappearance of epidemic pneumonia."

* First eight months.

It is noted that among the 24,000 negroes coming to the Isthmus in 1905 there was a very small proportion of persons who had been there before, whereas among the 21,000 coming in 1912 there was a very large proportion ; this has also to be considered.

Gorgas advises that the question of immunisation for pneumonia as recommended by Wright should be carefully looked into. As tried on the Rand the inoculated did not show any greater protection than the controls, but as used in the Premier Mine in 1913 the results seem very striking.

"In 1912, the 17,000 inoculated had a death-rate from pneumonia of 6·89 per thousand, and the 6,700 controls a death-rate of 17·72 per thousand. The inoculated and controls were selected at random, and I can see no reasonable explanation for the marked difference between the pneumonia death-rate of the inoculated and that of the controls, except that the inoculation gave a large degree of protection to the inoculated."

Darling has suggested that the vaccine used at the Premier mine was made from a different strain than that used on the Rand.

With regard to the housing of the natives, Gorgas remarks that the quarters are much too crowded ; each man has in general 200 cubic feet of air space, which would give him 14 feet of floor space. The occupants are thus forced into close personal contact. He is also struck by the character of the rations ; the two chief components are 21 pounds of mealie meal and $5\frac{85}{100}$ ounces of meat per diem. This he thinks is a great deal too large a proportion of carbohydrate for men doing hard manual labour. On the Isthmus there was at first a good deal of trouble as to rations. "The whole matter of food was satisfactorily settled both for the negro and ourselves when the families came and when we established commissaries for the sale of food at cost. The negro then bought what he liked in such quantities as he wished and his wife cooked it in the manner in which they had been accustomed."

A. G. B.

Rowland (E. D.). **Pneumonia in British Guiana.**—*Brit. Guiana Med. Ann. for 1913.* pp. 38–74. With 20 tables and 3 charts. 1914. Letchworth : Garden City Press, Ltd.

Pneumonia is responsible for a large number and a high percentage of deaths in British Guiana, especially among able-bodied labourers during their most productive age. Apart from more accurate diagnosis the author inclines to the belief that there has been a true increase in the number of cases. A table shows that in 30 years the deaths have risen from 240, or 2·8 per cent. of the total mortality, to 727 or 8·3 per cent. In twenty years the population has increased from 252,000 to 296,000 (males, 153,700 ; females, 142,300), but while the total number of deaths has only slightly increased the number of deaths from pneumonia has more than doubled. Reference is made to the previous history of the disease in the Colony and the writings of Grieve, Law, Ferguson, Daniels and Wise are quoted. In 1896 Daniels drew attention to the high rate of this disease amongst the East Indians. The author states that it is extremely rare in the prisons and seldom seen in the lunatic asylum.

Another table shows that the disease is widely distributed throughout the Colony and is possibly even more prevalent in the country than in the towns. Sixty per cent. of all cases are East Indians and the greater number males. Table 4 (reproduced) shows the cases of pneumonia treated in the Public Hospital at Georgetown for four years.

TABLE IV.—Return of Cases of Pneumonia treated in the Public Hospital, Georgetown, for the years 1910, 1911, 1912, and 1913, showing the sexes of the persons treated, their residence before admission and those who died.

Race.	Cases.			Residence. Town.		Country.		Died.		
	M.	F.	Tot.	M.	F.	M.	F.	M.	F.	Tot.
Europeans ..	9	2	11	7	1	2	1	2	1	3
Portuguese..	28	9	37	17	6	11	3	13	6	19
East Indians	571	90	661	129	24	442	66	254	44	298
Chinese ..	5	..	5	1	..	4	..	4	..	4
Aborigines ..	16	5	21	1	..	15	5	11	3	14
Blacks ..	342	129	471	173	82	169	47	103	52	155
Mixed ..	47	12	59	39	10	8	2	15	5	20
Total ..	1018	247	1265	367	123	651	124	402	111	513

The table brings out the higher rate among the men as well as the fact that the greater number came from the country, 59·6 per cent. as against 40·4 from the town; in England pneumonia is a disease of town life. Figures are given which show that an abrupt increase in the pneumonia rate synchronised with the arrival of influenza in 1890. Since 1910 there has been a fall in the number of deaths. Charts show that the disease does not prevail at any definite season nor during any special month, and that it is related neither to the monthly nor annual rainfall.

The case mortality in the London hospitals for a period of ten years is given as 21·8 per cent.; in the public hospitals in British Guiana the rate before 1906 was 59 per cent. and more; in 1912 it was as low as 40 per cent. In the Estates' Hospitals the case mortality is lower—30 to 40 per cent. Another table furnishes the reason for the high death-rate at the Public Hospital at Georgetown: 50 per cent. of the cases died in less than 72 hours; that is to say, they are brought too late for any beneficial treatment and probably many are killed by the journey.

As table 4 shows, the cases chiefly occurred amongst the East Indians and the blacks; they form 80 per cent. of the population and their pneumonia rate is as high as 90. Fifty-one per cent. of the East Indians are Creoles, but the pneumonia rate is 19·8 per cent. Creoles and 81 per cent. natives of India.

"All these figures show that the East Indians, natives of India, suffer most of all our races, and the males are specially victims. These are our most ignorant people, living on the poorest food and dwelling in the worst houses, and are perhaps our hardest and most industrious labourers. The peculiar predilection of the males to this disease is curiously exemplified in this race. Here the men and women live under the same conditions, occupy similar rooms, do more or less similar field work, the women

being exempt from the harder labour of shovel and fork only, suffer the same anchylostome infection, and yet there is this great disproportion in the incidence of the disease."

"'All races who can live in decent houses with no crowding in the sleeping rooms and little or no privation do not suffer from this disease; but all persons, of no matter which race, who live in small, ill-ventilated houses and crowded bedrooms, and who have barely a living wage as a result of their hard labour and a minimum of food, suffer and suffer badly.'

In England pneumonia affects men to a higher extent than women, which is attributed to the greater alcoholic habits of the males. This is not an adequate explanation in British Guiana for the East Indian is a teetotaler; ankylostomiasis is probably a more important factor. [Is this more common in men ?]

With respect to age distribution, of the 1,265 cases 55 per cent. were between 20 and 40; the disease was rare in children under one year.

Under the heading Treatment, the author emphasises the fact that the disease is due to the pernicious habit of sleeping in ill-ventilated rooms. "A man does not develop pneumonia because he is trained up in the fields, but he does develop the disease by sleeping in the foul germ-laden atmosphere of an ill-ventilated room." "An adult requires 3,000 cubic feet of fresh new air every hour; when everyone has this pneumonia will disappear from our mortality." He goes on to say that better housing is required throughout the whole Colony. Even the rooms in the coolie ranges leave much to be desired. "The enormous drop in the death-rate from 60 and 70 per cent. in the case mortality prior to 1906 at the Public Hospital, Georgetown, to 45 per cent. in the following years was brought about in great part by changing the patients to better ventilated wards, where they were given over 100 square feet of floor space and . . . . ample ventilation."

Many instructive tables are appended to the paper.

[This paper and that of GORGAS are specially useful to those who are responsible for the health of large bodies of labourers in the tropics. Information as to the diet of the East Indian labourers in British Guiana would be of value, as well as details of their housing. Perhaps these are to be found in the Surgeon-General's Reports. It would also be of interest to know whether the incidence is specially on newly arrived labourers as in the Isthmus of Panama.]

A. G. B.

Book Review.

Noeller (Wilhelm). **Die Uebertragungsweise der Rattentrypanosomen. Ein experimenteller und kritischer Beitrag zur Kenntnis des Uebertragungsproblems der Trypanosomen überhaupt mit besonderer Berücksichtigung der parasitischen Protozoen einiger Haustierflöhe.** —83 pp. With 8 text-figs. and 2 plates. Reprinted from *Archiv für Protistenkunde.* Vols. 25 and 34. 1914. Jena: Gustav Fischer. (Price 3 Mk.).

This work is a reprint in pamphlet-form of the two papers published by the author in the *Archiv für Protistenkunde,* Band xxv (1912), p. 386 and Band xxxiv (1914), p. 295. The first of these papers was reviewed in the *Sleeping Sickness Bulletin,* Vol. iv, p. 215; the second in the *Tropical Diseases Bulletin,* Vol. iv, p. 269. In this review it is proposed, first, to discuss the results obtained by Nöller in their general bearing, theoretical and practical; secondly, to criticize some details of Nöller's work in the light of recent experience.

The outstanding discovery made by Nöller is the clear and convincing demonstration, confirmed by Wenyon* and others, that *Trypanosoma lewisi* passes from the flea to the rat in the faeces of the flea, by the faeces being deposited on the skin of the rat and licked off, while still moist, by the rat. If the faeces of the flea contain the small stumpy trypanosomes which are the final form of the development of *T. lewisi* in the flea, the rat becomes infected. The small trypanosomes cannot, however, withstand desiccation and, if the faeces are dried before being licked off, no infection takes place.

In these results we have, therefore, for the first time the definite proof that a trypanosome can be transmitted from its invertebrate to its vertebrate host by the "contaminative" method, and it is no longer necessary to suppose that the transmission from invertebrate to vertebrate must be in all cases of the "inoculative" type, that is to say, that the parasite must pass into the vertebrate through the proboscis of the invertebrate during the act of blood-sucking.† It should be noted further in this connection that the numerous experiments undertaken by many investigators in order to prove transmission of *T. lewisi* by the proboscis of the flea in the act of blood-sucking have all, without exception, given negative results, and it seems certain that inoculative transmission does not take place in this instance.

**Jl. London School Trop. Med.*, ii, pp. 119–123.

†The reviewer suggested the possibility of a contaminative transmission of this kind in 1907 (*Proc. Roy. Soc.* B, lxxix, p. 39), when describing the cysts of "*Trypanosoma grayi*" but was told in conversation by one of the leading authorities upon tropical medicine in this country that his notions were "far-fetched" and unpractical. Nöller's results show the necessity for maintaining a more open mind upon such questions. With regard to the problematic and extremely polymorphic flagellates found in *Glossina palpalis* and generally lumped together under the designation "*Trypanosoma grayi* Novy," it seems very probable that this name covers, in reality, the developmental stages of several distinct species of *Trypanosomidae.* The investigations of Kleine (*Deutsch. med. Woch.*, Vol. xxxvi, pp. 1,400–1,403) and Kleine and Taute (*Arbeiten k. Gesundheitsamt,* xxxi, pp. 350–353) show that "*T. grayi*" includes the developmental stages of the trypanosome of the crocodile; while the fact that "*T. grayi*" was found swarming in a tsetse which had been bred from a pupa and fed on the blood of a fowl (*Proc. Roy. Soc.* B, lxxviii, p. 252), indicates that the name covers also developmental stages of bird-trypanosomes transmitted by the fly. On the other hand, Roubaud's investigations indicate that a flagellate parasite of the fly, "*Cystotrypanosoma grayi,*" is also included under the specific name (*C. R. Soc. Biol.* lxxii, p. 440). There is no reason why an omnivorous blood-sucker like the tsetse-fly should not transmit several species of trypanosomes of wild animals, since it is well known that a given species of fly, *G. palpalis,* for example, can transmit more than one species of pathogenic trypanosome.

The discovery of contaminative transmission of trypanosomes by the invertebrate host is very interesting, in the first place, from the theoretical and phylogenetic stand-point. According to the view put forward first by LÉGER, supported by BRUMPT, and now generally held to be true, the *Trypanosomidae** are a group of flagellates parasitic primarily in the digestive tracts of invertebrate hosts. The primitive type is seen in the genera *Leptomonas*, *Herpetomonas* and *Crithidia*, which have a monogenetic life-cycle (without alternation of hosts) and are transmitted from host to host by the contaminative method, in the form of resistant, encysted, non-flagellated (leishmanial) forms, the so-called post-flagellate† phase of PATTON. The next advance upon this ancestral type was brought about when some of the invertebrate hosts took to a blood-sucking habit, whereby the flagellate parasites in their digestive tracts became habituated to life in vertebrate blood as a nutritive medium. The final step was accomplished when certain of these flagellate parasites succeeded in passing in some way (perhaps in different ways in different cases) from the blood-sucking invertebrate into the vertebrate, and thus establishing themselves as parasites of the blood or tissues of the latter. Thus arose, in all probability, the species of the genera *Trypanosoma* and *Leishmania* (*sensu strictiori*), digenetic parasites with an alternation of hosts, vertebrate and invertebrate.‡ Present knowledge indicates, so far as it goes, that the species of *Trypanosoma* arose ancestrally from species of *Crithidia*, and those of *Leishmania* similarly from species of *Leptomonas*; since trypanosomes exhibit crithidial forms, and leishmanias leptomonad forms, in their development in the invertebrate host; a peculiarity easily explained as a reversion to an ancestral type of form and structure under ancestral conditions of life and environment.

If now the theory of LÉGER and BRUMPT be correct, it follows that the primitive method of transmission from host to host in the *Trypanosomidae* generally was the contaminative method, that is to say, through the faeces of the invertebrate. In this way they must have passed originally from invertebrate to invertebrate, and in this way they may well have obtained a footing in the vertebrate host, and have been transmitted from invertebrate to vertebrate, in the first instance. It is therefore of extreme interest to find that in *T. lewisi* the infection still passes from the flea to rat by the primitive contaminative method.§ There is, indeed, one important difference between the mode of transmission of *T. lewisi* and that of the monogenetic insect-flagellates. In the latter the propagative phases, as already mentioned, are resistant, encysted leishmanial forms, but in *T. lewisi* the final, infective phase of

*By the term *Trypanosomidae* is to be understood the section of the Haemoflagellates characterized by the possession of a single flagellum. The biflagellate genera *Trypanoplasma* and *Prowazekia* constitute quite a distinct group, to which the phylogenetic speculations of LÉGER and BRUMPT probably do not apply.

†The term "post-flagellate" lays emphasis upon a point which is immaterial namely the absence of a flagellum; the point which is of main importance for the contaminative transmission is that the non-flagellated leishmanial form is encysted and thereby able to resist desiccation as shown by WENYON in the case of *Leptomonas pattoni* of the flea (*Trans. Trop. Med. Hyg.* vii, pp. 103, 104). The ordinary trophic leishmanial form, that is say the form which grows and multiplies and is actively parasitic, cannot resist desiccation, as WENYON has also shown.

‡It has been proposed to abolish the genus *Leishmania* and to include all the species under *Leptomonas* (*Herpetomonas*). But as WENYON has pointed out (*Parasitology* iii, p. 69, footnote,) it is convenient, to say the least, to retain the generic name *Leishmania* for the digenetic species, with alternation of vertebrate and invertebrate hosts, and *Leptomonas* for the monogenetic species parasitic solely in invertebrate hosts. This does not preclude our recognizing leishmanial forms in the development of *Leptomonas*, or leptomonad forms in the development of *Leishmania*.

§The experiments of BRUMPT, cited by Nöller, indicate that the Brazilian human trypanosome (*T. cruzi*) can also be transmitted through the faeces of the invertebrate host, the bug *Conorhinus* (vel *Triatoma*); but, as Nöller has pointed out, BRUMPT obtained his infections by intra-peritoneal inoculations of the faeces of the bug, and not *per os*.

the development in the flea is a little stumpy trypanosome-form which cannot withstand desiccation. In all other species of trypanosomes, of which the development in the invertebrate host has been fully studied, the final form of that development is also a trypanosome-form. But the data are as yet inadequate to support the general statement that the form in which trypanosomes are transmitted from the invertebrate to the vertebrate host is always a trypanosome-form; should this prove, however, to be a universal peculiarity of trypanosome-development, it is best interpreted as a secondary developmental adaptation or modification, whereby the primitive encysted leishmanial form has been replaced by a precociously-developed trypanosome-form as the final infective stage of the cycle in the invertebrate. Nothing is known as yet with regard to the form in which the species of *Leishmania* pass from the invertebrate to the vertebrate host; but it is worthy of note that according to PATTON* the final stage of the development of *Leishmania donovani* in *Cimex* spp. is an encapsuled leishmanial form, which he considers to be homologous with the "post-flagellate" phase of monogenetic leptomonads, although he does not appear to have considered the possibility that this form might serve for contaminative transmission, as in the true species of *Leptomonas*.

It must be pointed out, finally, in discussing the problem of transmission, that the contaminative method, as seen in *T. lewisi*, is a very casual method which often fails to infect, even when the flea is known to be infective.† On the other hand, infection by the inoculative method is a practical certainty when the infective forms of the parasite are present in the salivary glands of the proboscis of the invertebrate blood-sucking host, and there can be no doubt that inoculation is a far more efficient method of transmission than contamination. In considering the relationship of these two methods, it may be that the contaminative method was the more primitive in all cases, and that it has become replaced secondarily, in most cases, by the much surer inoculative method; it may be, on the other hand, that in many cases the primitive monogenetic parasite succeeded in establishing itself in the salivary glands of the invertebrate host, and from thence succeeded in obtaining a footing in the vertebrate by direct inoculation. There is not at present enough concrete evidence to make the one or the other of these two possibilities the more probable.

From the purely practical point of view the discovery of Nöller leads to some important considerations. Apart from the fact that it indicates methods of dissemination, which have not as yet been reckoned with sufficiently in the investigation of blood-parasites, another possibility must be pointed out which is well worth bearing in mind by those engaged in the study of the modes of infection; namely, that if the parasite can pass from the invertebrate to the vertebrate host by faecal contamination, it is not necessary that the invertebrate host should be a blood-sucking insect in all cases. If, for instance, the parasite could pass out of the vertebrate host also in the faeces, in some form in which it could be taken up by some larval or adult invertebrate which feeds on the faeces (such as, for example, a house-fly), it might then be returned to the vertebrate again by the contaminative method.‡

A few points in Nöller's memoir call for short notice and criticism. The first of these relates to the question of direct or mechanical infection with *T. lewisi* by means of the flea. Nöller does not appear to have investigated the problem himself, and his statements with regard to the work of others are not accurate. He states on p. 9 (=388**) that "Swellengrebel and Strickland . . . furnished

**Scientific Memoirs by Officers of the Medical & Sanitary Departments of the Government of India*, No. 53, 1912.

†Compare MINCHIN and THOMSON, *Quart. Journ. Micr. Sci.* lx, part 4 (Jan. 1915), pp. 640 & 662.

‡See MACKIE (*Indian Jl. of Med. Research*, ii, pp. 510–515) on the possibility of the infection of kala azar passing out of the human body in the faeces. Mackie raises the possibility of direct contamination from man to man but does not seem to have considered the possibility of the intervention of some dung-feeding insect.

**The pagination given in brackets is that of the original publication in the *Archiv für Protistenkunde*.

the proof that a mechanical infection can occur when the fleas are interrupted during sucking on an infected rat and thereupon continue the act of suction immediately on a clean rat (*unmittelbar darauf den Saugakt auf einer gesunden Ratte fortsetzen*). The only references to mechanical transmission which the reviewer has been able to find in the works of the authors named are the following :—

(i) Strickland and Swellengrebel, *Parasitology* iii, p. 442 : "*Experiment* 10.—Fleas were used which had been raised in the laboratory, in the manner advised by the Indian Plague Commission, in large boxes in which a flea-infested rat had been placed. Under such conditions the fleas readily multiply in the filth which soon collects in the box. Eleven of such fleas were fed for one hour on a rat whose blood had showed *T. lewisi* for 12 weeks. After 24 and 72 hours the fleas were again fed on a "clean" rat D. Rat D became infected in 7 days. After this the fleas were fed at intervals on a series of "clean" animals, but they did not infect the rats again till the 34th day."

(ii) Ibid. p. 444. "The following experiment seems to indicate that 'mechanical' transmission is effected by the bite: *Experiment* 18.—Ten fleas from an infected rat were fed within 24 hours on a clean rat *through gauze*, with resultant infection. After this the fleas were similarly fed on a series of animals with negative results for about four weeks. They were then put on another rat and left on it and this became infected."

It is clear that neither of these experiments conform to Nöller's description of interrupted feeding, since in both experiments the fleas were transferred from one rat to the other with intervals of 24 hours, and *not* "unmittelbar darauf." It should be added that neither of the experiments of Strickland and Swellengrebel are in the least convincing as a proof of mechanical transmission. The most likely interpretation of Exp. 10 is that amongst the fleas on "the flea-infested rat" were some that were already infected with *T. lewisi*. It is not stated whether the flea-infested rat was a wild rat, but if so it might well have had an infection of *T. lewisi* and recovered from it, in which case it would show no trypanosomes in its blood and would be immune to a fresh infection from any infected fleas on it. The most probable explanation of the result obtained in Exp. 18 is either that the supposed clean rat had already acquired an infection elsewhere, or that some, or at least one, of the fleas used escaped on to it.

Various data have now accumulated which render a mechanical transmission of *T. lewisi* by the flea highly improbable and in need of very rigorous and convincing proof before it can be accepted as really taking place under either natural or artificial conditions. Nöller states on p. 20 (=399) and p. 24 (=403) that the dog-flea feeds eagerly ("*mit Behagen*") for several hours uninterruptedly on the same spot of the rat's skin and defaecates frequently during this time,* passing faeces from 7–15 times during the act of suction. If the flea be fed on a well-infected rat, many actively-moving trypanosomes are found in the first drops of faeces passed half an hour after the flea begins to suck. On pp. 40 and 41 (=419 and 420) it is shown that these trypanosomes, which have passed straight through the flea, do not produce infection of the rat when placed on its tongue, although infection is produced readily in this way when the final forms of the development in the flea, the little stumpy trypanosomes, have appeared five days later in the faeces of the flea. Minchin and Thomson showed that *T. lewisi*, after being 35 minutes in the flea's stomach, failed to infect clean rats when injected into them.† From these observations it is clear that *T. lewisi* is altered in its physiological properties, in such a manner that it can no longer infect rats, so soon after it passes into the flea's body that the possibility of a mechanical infection becomes extremely slight. To this should be added further that Minchin and Thomson were never able to observe trypanosomes in the proboscis of the flea, nor to produce infections by inoculation of proboscides into rats.

Nöller discusses (p. 18 =397) the precautions (*Vorsichtsmassregeln*) taken by others in their experiments on transmission (*Uebertragungsversuche*), especially that of using only bred-out insects in the experiments in order to avoid making use of insects which, if caught wild, might be already infected with the parasites which are the subject of the investigation. He remarks that the use of bred-out fleas only guards against their being infected with trypanosomes of vertebrates, and is no guarantee against infection with the specific parasites of the flea, since the larvae of the fleas can be infected with flagellate parasites, and thus even bred-out fleas may have an infection with them. He states that he was able to dispense with the use of bred-out fleas, since his method of tethering

*These statements do not apply at all to the rat-flea *Ceratophyllus fasciatus*, which sucks only for a relatively very short time, not more than 2½ minutes, and does not defaecate while feeding; compare Strickland and Swellengrebel (*l.c.*, p. 444) and Minchin and Thomson (*l.c.*, p. 653).

†*l.c.*, p. 634.

fleas made it possible for him to examine during life every flea that he used so exactly (*genau*), that he could detect an infection with Flagellates with certainty (*eine Infektion mit Flagellaten mit Sicherheit feststellen kann*).

There is a strange confusion of ideas here. The presence of specific flagellate parasites in the insects is without any bearing on the validity of positive transmission-experiments. If an experiment with fleas or other insects proves that they transmit *T. lewisi* or any other parasite of vertebrates, the conclusion drawn from the experiment is quite unaffected by the presence in the flea of parasites specifically distinct from the parasite of the vertebrate in question. If the specific parasites of the insects could have any effect on such transmission-experiments, it could only be in producing negative results, for example, if the parasite of the vertebrate were unable to develop in the gut of an insect already fully occupied by its own specific parasite. And it may be added further that those who know from experience how easily a scanty infection with flagellates may be overlooked in a flea, even after dissection and careful microscopic examination, will be inclined to be sceptical with regard to Nöller's claim to be able to detect such infections in the living flea.

On the other hand specific infections of the insect-host may be a source of confusion and error to those studying the morphology and sequence of the various types composing the developmental cycle of a parasite in the insect-host. It is remarkable that Nöller seems to have fallen himself into just the trap against which he warns others, and not to have distinguished clearly between the stages of *T. lewisi* in the flea and those of the *Leptomonas* sp. which, as he acknowledges, occurred frequently in the fleas used by him in his experiments. On the other hand Minchin and Thomson* claim to have avoided any such confusion, since they worked with two distinct strains of bred fleas, the one entirely free from any *Leptomonas*-infection, the other heavily infected with *Leptomonas pattoni*; consequently, in the one strain they were able to study the development of *T. lewisi*, quite free from admixture of stages of leptomonads, while in the other they were able similarly to study, for comparison, the forms of a pure infection of *L. pattoni*. Now comparing the two accounts, certain discrepancies are at once apparent. Nöller writes (p. 40 =419) "A distinction between the rat-trypanosomes in the dog-flea and the *Leptomonas* is extraordinarily easy, since in the trypanosomes forms with typical undulating membrane are almost always (*fast stets*) present in addition to the stages of the multiple division, while the *Leptomonas*-clumps consist throughout of oval forms in which I have not yet found an undulating membrane." But the typical haptomonad phase of *T. lewisi* is also a rounded or oval form without any trace of an undulating membrane, often without a free flagellum, and is quite indistinguishable from the corresponding stage of *L. pattoni* (compare Minchin and Thomson, l.c., pl. 41, figs. 166–168, and pl. 42, figs. 220–230, 241–252, 277, etc., *T. lewisi*, with pl. 42, figs. 278, 279, *L. pattoni*); and Nöller's figure of "*Leptomonas* spec." (Fig. 1, p. 16 =395) might represent the haptomonad phase of either *T. lewisi* or of a *Leptomonas*. The two parasites are only clearly distinguishable in the nectomonad phase, which represents as it were the typical, adult, specific form of the parasites in each case (compare Minchin and Thomson, l.c., pl. 41, fig. 196, pl. 42, figs. 254, etc., *T. lewisi*, with pl. 42, figs. 285, 286, *L. pattoni*). In the nectomonad phase *T. lewisi* shows a rudiment of an undulating membrane, not very distinct, of which there is no trace in *L. pattoni*, and the form and structure of the body differs markedly in the two cases. Nöller does not appear to have seen the nectomonads of his *Leptomonas*. Again Nöller states that the fixed trypanosomes multiply actively by binary fission and multiple division; Minchin and Thomson found multiple division in *Leptomonas pattoni* but never in the crithidial phase of *T. lewisi*, in which the multiplication was found to be invariably by means of binary fission. These discrepancies in the two accounts can only be explained either by supposing that Nöller did not distinguish clearly between the stages of *Leptomonas* and the crithidial stages of *T. lewisi*, or on the very improbable supposition that the development of *T. lewisi* in the dog-flea differs from that which it goes through in the rat-flea.

On p. 26 (=405) Nöller states that in a flea four days after the first infective feed he found the intestines lined by a continuous layer of flagellates of "pronounced trypanosome-form," the "blepharoplast" close to the hinder end or near the nucleus, the undulating membrane strongly developed. This description does not recall in the least the proctodeal phase of *T. lewisi*, which is a typical crithidial form, but suggests rather the forms of the degenerative series, of which Nöller makes no mention.

Nöller explains the mechanism of the dissemination of the trypanosome from the flea (p. 60 –313, part II) by supposing that the trypanosomes must multiply in the intestine (*Dünndarm*) to such an extent that they present an obstacle to

*l.c., p. 479.

the passage of the faeces, till finally masses of trypanosomes are torn loose by the faeces and so pass out from the rat. But in the rat-flea, at least, the trypanosomes develop usually in the rectum and are rarely found in the intestine, except in its pyloric region, and infection may be produced by fleas which possess themselves an extraordinarily scanty infection in the proctodaeum. There can be no doubt that the final infective trypanosome-form becomes loose from its attachment from the wall of the proctodaeum and passes out of the flea without necessarily any pressure exerted by the faeces to dislodge it.

At the conclusion of his work Nöller gives a classification of trypanosomes based on their method of transmission. He recognizes three main groups of trypanosomes, with subdivisions, as follows :—

1. Trypanosomes transmitted by leeches
   - (*a*) The group of *T. inopinatum*, a true parasite of the leech, *Helobdella*, in which it can be transmitted from parent to offspring.
   - (*b*) Trypanosomes not transmitted from parent to offspring in the leech.
     - (i) Trypanosomes of marine fishes and of tortoises : first divisions in the leech takes place in leishmanial forms.
     - (ii) Trypanosomes of freshwater fishes, probably also of Amphibia : first divisions in the leech take place in flagellated forms.
2. Trypanosomes transmitted by Arthropods
   - (*a*) Trypanosomes transmitted by fleas : *lewisi*-group, etc.
   - (*b*) Trypanosomes transmitted by bugs : *Schizotrypanum cruzi*.
   - (*c*) Trypanosomes transmitted by Diptera : the African pathogenic group, with further subdivisions.
   - (*d*) Trypanosomes transmitted mechanically by Diptera : *T. equinum* and *T. evansi*.
3. Trypanosomes that do not require an invertebrate carrier : *T. equiperdum*.

A classification of trypanosomes, based on a similar principle, but taking into consideration the vertebrate as well as the invertebrate host, and therefore differing in some particulars from Nöller's scheme, was put forward by the present writer in his lectures at the Lister Institute in 1913 ; he hopes to publish it before long and therefore reserves his detailed criticism of Nöller's classification for the present, merely stating his conviction that a natural classification of these flagellates must be based on their life-cycles and development. At the same time it should be pointed out that although the zoologist seeks only natural classifications, that is to say, classifications based on the genetic affinities of the organisms dealt with, an artificial but strictly logical classification may possibly serve better the requirements of those who approach the study of trypanosomes with other than zoological aims.

E. A. Minchin.

Reprints and Pamphlets received :—

BALFOUR (A.). Tropical Problems in the New World.—*Trans. Soc. Trop. Med. & Hyg.*, 1915.

CARINI (A.) & MACIEL (J.). Sobre o *Pneumocystis Carinii*.—*Ann. Paulistas de Med. e Cirurg.*, 1914.

CARINI (A.) & MACIEL (J.). Sobre a Molestia dos Cães, chamada Nambi-Uvú e o seu Parasita (*Rangelia Vitalii*).—*Ann. Paulistas de Med. e Cirurg.*, 1914.

CARINI (A.) & BOTELHO (C., Jr.). Alguns Trypanozomas de Passaros do Brasil.—*Ann. Paulistas de Med. e Cirurg.*, 1914.

CRISOSTOMO (E.). Terapeutica del Beriberi por los Compuestos Colestericos (Cerebrina, Paratoxina, Colesterina y Fitosterina).—*Actas, Mem. y Comunicaz. de la* 11 *Asamblea regional de Med. y Farm. de Filipinas*, 1914.

CROWELL (B. C.). Notes on the Diagnosis of Asiatic Cholera at Autopsy.—*Philippine Jl. Sci.*, 1914.

CROWELL (B. C.). The Chief Intestinal Lesions encountered in 1,000 Autopsies in Manila.—*Philippine Jl. Sci.*, 1914.

DARLING (S. T.). Murrina, a Trypanosomal Disease of Horses in Panama, and the Means used in Controlling an Outbreak.—*Trans. 15th Intern. Congress on Hyg. & Demography, Washington*, 1912.

DARLING (S. T.). The Identification of the Pathogenic Entamoeba of Panama.—*Trans. 15th Intern. Congress on Hyg. & Demography, Washington*, 1912.

DARLING (S. T.). Budding and Other Forms in Trophozoites of *Entamoeba tetragena* Simulating the "Spore Cyst" Forms Attributed to "*Entamoeba Histolytica*."—*Arch. Intern. Med.*, 1913.

DARLING (S. T.). Equine Piroplasmosis in Panama.—*Jl. Infect. Dis.*, 1913.

DARLING (S. T.). The Pathologic Affinities of Beriberi and Scurvy.—*Jl. Amer. Med. Assoc.*, 1914.

HONDA (K.). Ueber die pathologisch-histologischen Befunde des Nervensystems bei Beriberi—*Mitteil. d. med. Fakultät d. kais. Univ. z. Tokyo*, 1914.

LAMBERT (C.). Notes on the Treatment of Amoebic Dysentery with Emetine Hydrochloride, from Observation of Sixty Cases.—*China Med. Jl.*, 1914.

LAVERAN (A.). Les Leishmanioses chez les Animaux.—*Ann. Inst. Pasteur*, 1914 & 1915.

LAVERAN (A.). Nouvelle Contribution à l'Etude du *Toxoplasma gondii*.—*Bull. Soc. Path. Exot.*, 1915.

NAGAYO (M.). Referat über Beriberi oder Kakke. Pathologisch-anatomischer Teil.—*Verh. d. Japan. Patolog. Gesellschaft*, 1913.

SMITS (J. C. J. C.). Klinische Waarnemingen omtrent het Ulcus Tropicum.—*Geneesk. Tijdschr. v. Nederl.-Indië*, 1914.

STEPHENS (J. W. W.). On the Peculiar Morphological Appearances of a Malaria Parasite.—*Ann. Trop. Med. & Parasit.*, 1915.

STEPHENS (J. W. W.) & STOTT (W.). Studies in Blackwater Fever. III.—The Relationship of Quinine to Blackwater Fever.—*Ann. Trop. Med. & Parasit.*, 1915.

TERRY (B. T.). The Influence that Serum exerts upon Trypanosomes, with Special Reference to its Use for Experiments in vitro with Atoxyl and Paraminophenylarsenoxyd.—*Jl. Experim. Med.*, 1915.

Reprints and Pamphlets received—*cont.*

TERRY (B. T.). Different Amounts of Transformed Atoxyl produced by incubating 1 per cent. and 10 per cent. Atoxyl in Blood.—*Jl. Experim. Med.*, 1915.

TERRY (B. T.). The Effect of Heat on the Transforming and Binding Power of Blood.—*Jl. Experim. Med.*, 1915.

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